DESIGN OF WATER WORKS SYSTEM FOR RUSHVILLE - ILLINOIS

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1910

DESIGN OF A WATER WORKS SYSTEM FOR RUSHVILLE ILLINOIS.

A Thesis Presented

By

W. G. Jones.

A. G. Anderson

To

The President and Faculty

of

Armour Institute of Technology

For The Degree of

Bachelor of Science in Civil Engineering

Having Completed The Prescribed Course

In

Civil Engineering

Chicago, Illinois

May 1910.

Alfred E. Phillips Prof. Civil Engineering

H. M. Raymond Dean Eng. Studies

L. C. Monin Dean of Cult. Studies

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Design of A Water Supply System for

Rushville Illinois.

The design of this system was accomplished by the following steps:

1st. The field work, plotting of profiles of streets and making of a topographical map of the town.

2nd. Determination of amount and distribution of population. Determination of fire supply.

3rd. Designof the Distributing System and location of pumps and tanks.

4th. Design of elevated tank and tower.

5th. Design of pumps and pump house.

6th. Specifications and estimates.

Field Work.

Profiles of all streets and important alleys were made from elevations taken every fifty feet on the center line of the streets. The profiles were plotted and a topographical map also made contour lines being plotted for every two feet change of elevation.

Distribution of Population.

The population was considered in the ratio of five people to every fifty feet of frontage. This distribution makes a total population of ten thousand people which number allows for a large future growth. Allowing one hundred and ten gallons per capita daily the amount to be pumped each day is one

Design of A Water Supply System for Danville Illinois.

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(one)
million one hundred thousand gallons.

For the fire supply four hydrants will be allowed in use at any one time each hydrant supplying 175 gallons per minute or 1.55 cu. ft. per second for the four hydrants.

Design of Distributing System.

The pumps will be located on the lot adjoining the C. B. & Q. R. R. at the west end of Adams street. This is done for the sake of convenience in getting fuel supplies etc. The elevated tank will be built immediately adjoining the pumps this being a high section of the town.

The distributing system will be designed to supply the entire domestic supply for the day in a period of ten hours which is the period that the pumps will be operated. This is at the rate of 4.08 cu ft per second. No addition will be made for the fire supply it being considered that in case of necessity the fire supply will be furnished at the expense of a domestic supply. No main will be designed, however, to carry less than the fire supply of 1.55 cu ft per second.

The main distributing system will be as follows:

A large main will run east on Adams street from the pumps. From this Adams street main a main will run-

1st. South on Franklin St., designed to supply the district south of Adams St. and west of Jackson St.

2nd. South on Monroe St. designed to supply the district south of Adams St. between Jackson St. and Liberty St.

3rd. South on Morgan St. designed to supply the district

south of Adams St. between Liberty St. and Lincoln St.

4th. North on Liberty St. designed to supply the district north of Adams St. between the C. B. & Q. R. R. and Dewey St.

5th. East on Adams St. from Morgan St. designed to supply the district north of Adams St. and east of Dewey St. and south of Adams St. and east of Lincoln St.

The quantities supplied by the different mains will be -

District	Population	Dom. Sup.	Fire Sup.
1	1500	.61 cu ft /sec	1.55 cu ft/sec
2	2500	1.02 " " "	" "" "
3	3ooo	1.21 " " "	" "" "
4	1500	.61 " " "	" "" "
5	1500	.61 " " "	" "" "

The Adams St. main will be designed so that the section from Liberty St. to Morgan St. will supply districts 3 and 5; from Monroe St. to Liberty St. districts 3, 4 and 5; and from Franklin St. to Monroe St. districts 2, 3, 4 and 5. The main from the pumps south on Franklin St. to Adams St. will be designed to carry the entire supply of the town or 4.08 cu ft per second.

All pipes will be laid approximately five (5) feet below the surface, that depth sufficient to prevent freezing in this latitude.

For fire protection a pressure of 75 pounds per sq in is desirable at the hydrants and this will be the minimum pressure allowed in this system.

Design of Mains.

Liberty St. main (Adams St. to Scripps St.)

Q = 1.55 cu ft sec l = 1660 ft.

Rise 5 ft. Pressure at N. end 172.8 ft.

From table d = 10"; friction loss 4 ft. per 1000'

1.66 x 4 = 6.64 ft = total friction loss.

172.8 + 5 + 6.64 = 184.44 ft = required pressure at Adams and Liberty.

Adams St. main (Liberty St. to Morgan St.)

Q = 1.83 cu ft sec l = 1156 ft.

Fall 2.4 Pressure at Liberty St. 184.44

From table d = 10 in. Friction loss = 5.5 ft per 1000'

5.5 x 1.156 = 6.36 ft = total friction loss.

Pressure at Morgan St. 184.44 - 6.36 + 2.4 = 180.48 ft

Adams St. main (Monroe St. to Liberty St.)

Q = 2.43 cu ft / sec l = 745 ft.

Rise 2.1 ft Pressure at Liberty 184.44 ft.

From table d = 12"; friction loss 3.5 ft per 1000

3.5 x .745 = 2.61 ft = total friction loss.

Pressure at Monroe St. 184.44 + 2.61 + 2.1 = 189.15 ft

Adams St. main (Franklin St. to Monroe St.)

Q = 3.45 cu ft per sec l = 1470 ft.

Fall = 3.0 ft Pressure at Monroe 189.15

From table d = 12"; friction loss = 6.5 ft per 1000

6.5 x 1.47 = 9.55 = total friction loss

189.15 + 9.55 - 3 = 195.7 ft = pressure at Franklin.

Adams St. main (Morgan St. east to N & S St.)

Q = 1.55 cu ft sec l = 1675 ft

Fall 8.6 ft Pressure at Morgan St. 180.48 ft

From table d = 10"; friction loss 4 ft per 1000

1.675 x 4 = 6.7 = total friction loss

Pressure at east end = 180.48 + 8.6 -6.7 = 182.38 ft

Franklin St. main (Adams St. to Madison St.)

Q = 1.55 cu ft per sec l = 1740 ft

Fall = 11.4 ft Pressure at Franklin St. 195.7ft

From table d = 8" ; friction loss = 11.5 ft per 1000

11.5 x 174 = 20.01 ft = total friction loss

Pressure at Madison St. = 195.7 + 11.4 - 20.01 ft = 187.09

Monroe St. main (Adams St. to Alley S. of Clinton St.)

Q = 1.55 cu ft / sec. l = 2684 ft.

Fall 16.6 ft Pressure at Adams St. 189.15 ft

From table d = 10" ; friction loss 4 ft per 1000

2.684 x 4 = 10.74 ft = total friction loss

Pressure at S end 189.15 + 16.6 - 10.74 = 166 = 195 ft

Morgan St. main (Adams St. to Clinton St.)

Q = 1.55 cu ft / sec l = 2284.

Fall = 20 ft. Pressure at Adams St. 180.48 ft

From table d = 8" ; friction loss = 11.5 ft per 1000

Total friction loss = 11.5 x 2.284 = 26.22 ft

Pressure at Clinton St. 180.48 + 20 - 26.22 = 174.[illegible] ft

The remainder of the distributing system was designed to supply water at a convenient distance from all houses and to give all hydrants a sufficient fire supply. No pipe that might be required to supply a fire hydrant was made less that six inches in diameter. The size and length of all pipes are fully shown on the plot and in the schedule.

Hydrants.

Loss of head in hydrants 1.5 lbs

Using 2 1/2" hose with a 1" nozzle the loss per hundred feet of hose is 10 lbs. Two way hydrants will be used and will be so placed that any point can be reached from two hydrants with five hundred feet of hose. The total loss between water pipe and nozzle will be 51.5 lbs. or 120 ft. This allows a pressure at the nozzle of 52.5 ft. The location of the hydrants is shown on the plot.

Design of Elevated Tank and Tower.

The tank will be designed to have a capacity of 230,000 gallons. This is a domestic supply for one-third of a day for four thousand people. (The present population.) plus two hours fire supply. It is also sufficient for a day's domestic supply in case of a break down of the pumps.

Design of Tank.

Diameter 30 ft, height 35 ft. not including the hemispherical bottom. Total capacity 238000 gallons. The cylindrical shell will be made of steel plates each five feet deep and not less than 3/8 inches thick.

$2\ t \times 10{,}000 = 434\ h \times D$ where

t = thickness of plate ; D = diameter in inches

10,000 = tensile strength of steel

h = depth from top in feet

$t = .0078\ d$

Calculations show that 3/8" is sufficient thickness for all the plates of the cylinder.

Hemispherical shell

$Ct \times 10{,}000 = W$

C = circumference of cylinder = 1130.76 in

t = thickness of plate.

W = total weight of water in tank

t = .17" or 3/8" as the minimum.

Design of Tower

Weight of tower 1,983,333 lbs

Weight of tank 82,177

Total--- 2,065,510 lbs = 1032.7 tons

Six columns will give a fair distribution of this load and allowing for extra load not calculated 173 tons will be allowed as the load on each leg.

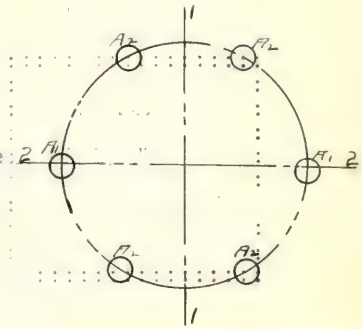
Besides the load of the tank the tower will be called upon to resist the force of wind load. Calculating this at

40# per square foot 55,300# will be applied to the tank including the roof at 5.5 above the center of the tank.

The wind pressure on the tower will be assumed at 200# per lineal foot or 5000# per panel.

The computation of dead load stresses involves no difficulties. A method of calculating the wind load stresses will now be worked out.

The figure shown to the right represents a cross-section of the tower at any point and the resisting moment of the section about the two neutral axes shown will be found.



First about 1 - 1

Let A = area of the cross-section of one post; p = unit stress and r = radius of circle.

$M = 2A_1 p_1 r + 4A_2 p_2 r \sin 30$

$= 2A_1 p_1 r + 2A_2 p_2 r$

But $p = 1/2\ p$ and $A = A_1 = A_1$

$p_1 = M/3Ar$ which is the maximum stress in any post.

Second about 2 - 2

$M = 4A_2 P_2 r \cos 30^\circ$

$P_2 = M/Ar \times 3.464$ which stress is smaller than p

Calculation of stress in Column B B Moments about A B

55,300 x 98	=	5,419,400	ft lbs
2,500 x 75	=	187,500	" "
5,000 x 50	=	250,000	" "
5,000 x 25	=	125,000	" "
Total		5,981,900	ft lbs

$r = 20.769$ ft

$A\ p = 5{,}981{,}900 / 3 \times 20.769 =$ 96,000 lbs

Load from tank	347,000 "
Wt of B B	5,000 "
Total	448,000 lbs

The secant of the batter angle is so small that the increase in stress due to the batter is not appreciable and will be neglected.

Diagonal Stress.

The stress in the diagonal will be the result of wind load only and the vertical component of a diagonal stress in any panel will be the difference of the loads found at the two panel points.

Diagonal $C_3\ D_2$

Vertical component 96,000# - 75,900# = 20,100#

Resolved a-long post

20,100 x 1.003 = 20,160#

Angle $C_3\ D_2\ D_3 = 40^\circ\ 31'$

20,160 x sec $40^\circ\ 31'$ = 26,410 lbs.

Stresses in struts

The stress in any strut equals the horizontal component of the diagonal stress.

$C_3\ D_3 = C_3\ D_2 \sin 38^\circ\ 20'$ = 16,375 lbs.

Design of Members.

Columns.

[illegible] = [illegible]

[illegible] = [illegible] = [illegible]

Load from tank [illegible]

[illegible] [illegible]

Total [illegible] lbs.

The amount of the bulkhead [illegible] is so small that the increase in stress due to the bulkhead is not [illegible] and will be neglected.

Horizontal Stress.

The stress in the diagonal will be the result of vertical load only and the vertical component of a diagonal stress in any panel will be the difference of the loads [illegible] the two panel points.

[illegible]

Vertical component [illegible] - [illegible] = [illegible]

[illegible]

[illegible] = [illegible]

Angle [illegible] = [illegible]

[illegible] = [illegible] lbs.

Stresses in [illegible]

The stress in any diagonal [illegible] the vertical component [illegible] of the diagonal stress.

[illegible] = [illegible] = [illegible] lbs.

[illegible]

[illegible]

[illegible]

(Design of Members--con.)

The columns will be built of Z bars and a flat plate

Column B B

Stress equals 448,000 lbs

Length equals 300.88 inches

p = 20,000 - 90 l/r

Assuming 4 - 6" - 3/4" Z bars with a 3/4 in. plate

r = 3.67 in.

p = 12,620 lbs per sq in

A = 40.31 sq in (Gross)

3.94 " " area of rivet holes

36.67 " " = net area

36.37 x 12,620 = 458,989 lbs

Therefore the assumed column will be used.

Diagonals

The diagonals will be built of angles all of the same dimension to carry the maximum load in any diagonal which is 30,580 lbs.

With an allowable tension of 16,000 lbs per sq in --

A = 30,580/16,000 = 1.91 sq in

With 3 1/2 x 3 x 3/8" angles A = 2.30 sq in

rivet holes .33 " "

net area 1.97 " "

Design of Members.

Struts between columns.

Use 2 - 8" - 11.25# channels latticed which will carry about 60,000 lbs.

[illegible]

The column will be built of [illegible] of [illegible] steel plates

Column No. [illegible]

Screen equals 156,000 lbs.

Tension equals 300.88 inches

$p = 20,300 - 90 \ 1/2$

Assuming 4 - 6" - 3/4" I beam with a 3/4" cover plate.

$r = 4.[illegible]$ in.

$= 12,[illegible]$ lbs per sq. in

$A = 10.[illegible]$ sq in. (Trans)

[illegible] " " " gross of rivet holes

36.37 " " " = net area

$36.37 \times 12,500 = 456,[illegible]$ lbs

Therefore the assumed column will be used.

Abutments

The abutments will be built of uniform all of the same thickness to carry the maximum load in any 4 panel which is 10,380 lbs.

With an allowable compression of 12,000 lbs [illegible]

$A = 10,380/12,000 = 1.[illegible]$ sq in

With a 1/6 x 3 x 3/8" angle $= [illegible]$

[illegible] 4 angles [illegible] " "

net area [illegible] 1.[illegible] " "

[illegible] area of [illegible].

[illegible]

[illegible] - 2" - 12.[illegible] of angle [illegible] [illegible]

[illegible] 10,[illegible] lbs.

Design of Foundation.

Load on each foundation 543,000 lbs.

Allowing 5,000 lbs per sq ft on earth

A = 109 sq ft or 10' - 6" x 10' - 6" for bottom dimensions.

Allowing 200 lbs per sq in on concrete

A = 2715 sq in = 4 ft - 5 in x 4 ft 5 in

A cast iron shoe anchored to the foundation by bolts will support directly the weight of the column.

Design of Pumps and Pumping Station.

The pumps will be designed for a capacity of 1,100,000 gallons per day to be pumped in ten hours which gives a capacity of 1833 gallons per minute.

From the catalogue issued by the Cameron Steam Pump Company a Compound Duplex Pump of diameter of 14 inches and stroke of 20 inches gave a capacity of 1,000 gallons per minute under ordinary speed. Two pumps of this size will be used.

A feed pump for the boilers and heater of size 4 1/2" x 2 3/4" x 4" will be used.

The size of the boiler is determined by finding the Boiler-Horse Power required and selecting a suitable boiler giving the required power. The Boiler-Horse Power is determined as follows.

Pumps work against a head of 235 ft.

1833 gallons of water pumped per minute.

1 gallon of water weighs 8 1/3 lbs.

Weight of [illegible] lbs.

Load on each condition 6,[illegible]00 lbs.

Allowing [illegible],000 lbs per sq ft on earth

A = 100 sq ft or 10' - 0" x 10' - 0" for footing

[illegible].

Allowing 200 lbs per sq in on concrete

A = 2016 sq in = 14 ft - 0 in x 14 ft 0 in

A steel iron plate anchored to the foundation by bolts will support directly the weight of the column.

Design of Pump and Engine Station.

The pump will be designed for a capacity of 1,10[illegible],000 gallons per day to be pumped in ten hours. Allowing river [illegible] - age of 1500 gallons per minute.

From the conditions known by the Operation [illegible] Company a Compound Duplex Pump of 18 inches of 14 inches of stroke of steam cylinder, capacity of 1,000 gallons per minute over-ridden by pump. [illegible] of [illegible] is adopted as [illegible].

A 1 in pump for the boilers and heater of size 1.[illegible] x [illegible] will be used.

The size of the boiler is determined by [illegible] Boiler-Horse Power required and allowing a [illegible] giving the required power. The boiler-horse power is determined as follows.

Pump work [illegible] head of 300 ft.

1000 gallons of water [illegible] hours.

[illegible] gallon of water [illegible] lbs.

1833 x 8 1/3 x 235 / 33,000 = 108 = total H.P. required.

Boiler Horse Power = 108 x 79.2 /30 = 285.

Boiler designed to give 285 Horse Power.

The pumping station is designed to give ample room for a boiler room, coal room, engine room and toilet room and is fully shown on the plans.

Rushville Water Works.

General specifications and conditions of agreement.

The work will be considered and detailed specifications are drawn under the following divisions:

1. Furnishing cast iron pipe and special castings.

2. Furnishing hydrants, valves and valve boxes.

3. Laying pipe and setting hydrants, valves and valve boxes.

4. Furnishing and setting up pumping machinery.

5. Furnishing and setting up boilers, heater, feed pump and accessories.

6. Furnishing material for and erecting pump house and chimney.

7. Furnishing material for and erecting water tank and tower.

Bidders will divide their bids, giving prices for the work under the separate divisions mentioned above, together with a lump bid for the construction of the complete plant.

[illegible]

[illegible]

Boiler [illegible] over = [illegible] = [illegible].

Boiler [illegible] to give [illegible] power.

The pumping station is designed to give single room or a boiler room, coal room, engine room and boiler room and is fully shown on the plans.

[illegible]

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The work will be considered and described specifications are drawn under the following divisions:

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2. Furnishing [illegible], valves and valve boxes.
3. Laying pipe and setting hydrants, valves and valve boxes.
4. Furnishing and setting up pumping machinery.
5. Furnishing and setting up boilers, [illegible], [illegible] and economizer.
6. Furnishing [illegible] for and erecting [illegible] and chimney.
7. Furnishing material for and erecting [illegible] and [illegible].

Tenders will divide [illegible], giving prices for the work under the separate divisions above, [illegible] [illegible] Lump bid for the construction of the [illegible].

It is intended that these specifications, and each contract and specifications shall cover the completion of the work to which it relates.

By the term "City" is meant the City of Rushville Illinois acting through its proper authorities.

Wherever the term "~~Capital~~ Water Works Committee" is used it shall be understood to mean the committee representing the Common Council in the prosecution of the work to be performed under and in accord ance with these specifications.

Wherever the term "Engineer" is used, it shall be understood to refer to the Engineer, in the employ of the city, having direct charge of the waterworks construction and to his authorized assistants.

Wherever the word "Contractor" is used, it shall be understood to refer to the party or parties contracting to perform the work to be done under these general specifications, or the legal representative of such party or parties.

Bids will not be received for the work involved under these specifications, except from parties having had experience in such work, and who can furnish satisfactory proof of their ability to carry on the construction of the whole or part of the system in a thorough and workmanlike manner.

The contractor is to furnish, at his cost and expense, all transportation, plants, tools, labor, materials and all else requisite to execute and complete the work in the best possible and most expeditious manner and according

It is intended that these specifications, and the con- tract and specifications shall cover the completion of the work to which it relates.

By the term "City," is meant the City of Danville Illinois acting through its proper authorities.

Wherever the term "Special "Water Works Committee" is used it shall be understood to mean the committee representing the Common Council in the prosecution of the work to be performed under and in accordance with these specifications.

Wherever the term "Engineer" is used, it will be understood to refer to the Engineer, in the employ of the City, having direct charge of the waterworks construction and his authorized assistants.

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Bids will not be received for the work involved under these specifications, except from parties having had experience in such work, and who can furnish satisfactory proof of their ability to carry on the same portion of the whole or part of the system in a thorough and workmanlike manner.

The contractor is to furnish, at his own expense, all transportation, plant, tools, labor, material and all other [illegible] [illegible]

[illegible]

to the drawings and specifications and their intended meaning.

He shall employ competent foremen and experienced mechanics and laborers and shalll discharge immediately, whenever requested by the engineer to do so, any man who is incompetent or disposed to be disorderly, and shall not again employ such person on the work.

All materials furnished and work done will be inspected by the Engineer, and if not in accordance with these specifications and contract, they will be rejected and immediately removed, and other work done and material furnished xxxxxx in accordance therewith. If the contractor refuses to remove the work and materials as above ordered, then the Engineer and Water Works Committee shall have the right and authority to stop the contractor and his work at once, and to supply men and materials at the cost and expense of the contractor; such expense to be deducted from any moneys then due, or to become due the contractor from the city.

And it is further intended that inspection shall not relieve the contractor from his responsibility to do true and accurate work; and the contractor shall furnish all necessary facilities, should it be deemed advisable to make any examination of the work already completed. If any be found defective in any respect, he shall defray the expenses of such examinations and of satisfactory reconstruction. If all be found satisfactory such expense will be paid by the city. The Engineer and Water Works Committee shall

[illegible]

[illegible] employee of a contractor or subcontractor engaged in the performance of public work, shall be required or permitted to work more than the prescribed or permitted number of hours in any calendar day or more than the prescribed or permitted number of days in any calendar week, and shall not knowingly permit such person to work.

All materials furnished and work done shall be inspected by the Engineer, and if not in accordance with these specifications and contract, they shall be rejected and immediately removed, and other work done and materials furnished in accordance therewith. If the contractor refuses to remove the work and materials rejected as above or, when the Engineer and Water Works Committee shall have the right and authority to stop the contractor and the work if necessary, and to supply men and materials at the cost and expense of the contractor, such expense to be deducted from any moneys then due, or to become due the contractor from the city.

And it is further intended that inspection shall not relieve the contractor from his responsibility to do true and accurate work; and the contractor shall furnish all necessary facilities, upon it's request and ability to make any examination of the work thought expedient. If any defective work or materials in any respect, is found during the progress of such examinations or after completion, it shall be lawful for the Engineer to reject the same, and the contractor shall remove and replace such defective work or materials at his own cost and expense, and the contractor shall be

have the right to reject, at any time previous to the final settlement with the contractor any work or materials which may be found faulty, even though such faults may have been previously overlooked.

The successful bidder must sign the contract for the work to be done by him, within ten days after the contract is awarded to him, and must begin work at the time fixed for him to begin, in accordance with the detailed specifications for the several portions of the work. He shall proceed with the work, prosecuting it with due diligence from day to day, and complete it at the time fixed.

The contractor must follow strictly and without delay all instructions and orders given by the Engineer in the performance of his work. In the event of the contractor's absence from the work, he must leave it in charge of a duly authorized representative, to whom orders and instructions may be given. If he fails to do this, then the contractor will be held responsible for the proper carrying out of such orders and instructions as it may be necessary for the Engineer to give to any superintendent, foreman or other employee about the work.

The contractor will be held responsible for the entire work until completed and accepted by the city, and until he is formally released from his obligations. He is required not to assign or sublet his contract without permission from the city, but must keep it in his name and control until completed and accepted, and in case of his absence from the work must have a duly qualified person to take care of it.

work. He failure to replace, at any time previous to the final settlement, of the contractor any work or materials which may be found faulty, even though such faulty work have been previously overlooked.

The successful bidder must when he contracts for the work to be done by him, within ten days after the number of it awarded to him, and must begin work at the time fixed for him to begin, in accordance with the detailed specifications for the general portion of the work. He shall proceed with the work, prosecuting it with due diligence from day to day, and complete it at the time fixed.

The contractor must follow strictly and without delay all instructions and orders given by the Engineer in the performance of his work. In the event of the contractor's absence from the work, he must leave it in charge of a duly authorized representative, to whom orders and instructions may be given. If he fails to do this, then the contractor will be held responsible for the proper carrying out of such orders and instructions as it may be necessary for the Engineer to give to any superintendent, foreman or other employee about the work.

The contractor will be held responsible for the entire work until completed and accepted by the city, and until he is formally released from its obligations. It is required not to assign or sublet his contract without permission from the city, but must keep it in his name and control until completed and accepted, and in case of his absence from the work must have a duly qualified person to take care of it.

(10)

All proposals shall state the time that the bidder proposes to complete the work for which he is bidding. Other factors being equal preference will be given to the proposal offering the earliest completion and fulfillment of the contract in question.

The contractor will be required to forfeit as confessed and liquidated damages to the city the sum of fifteen ($15.00) per day for each and every day the final completion of his contract is delayed beyond the time specified in his accepted proposal, and he will in addition to the above penalty be required to reimburse said city for any and all damages and increased cost of work to the city by reason of such delay or from any other cause connected with his or their contract with the city.

No charge shall be made by the contractor for any delays or hindrance from any cause during the progress of any portion of the work embraced in his contract.

If the delay be caused by any act or neglect of the city, then he will be entitled to an extension of the time allowed for the completion of the work, sufficient to compensate for the delay, provided the contractor shall give the city immediate notice of the cause in writing. If the contractor fails to complete the work at the date specified he shall forfeit to the city, as confessed the liquidated damages and amounts named in each of the specifications for the different portions of the work.

Before the work will be considered as completed, all

All proposals shall state the time of the bidder to complete the work for which he is bidding. Other bidders being equal preference will be given to the proposal offering the earliest completion and fulfillment of the contract in question.

The contractor will be required to furnish a contract and liquidated damages to the city the sum of fifteen ($15.00) per day for each and every day the final completion of the contract is delayed beyond the time specified in the accepted proposal, and he will in addition to the above penalty be required to reimburse said city for all expenses and increased cost of work to the city by reason of such delay or from any other cause connected with his or their contract with the city.

No change shall be made by his contractor for any delays or interruptions from any cause during the progress of the execution of the work authorized in his contract.

If the city be delayed by any act or neglect of the city, then he will be entitled to a extension of time allowed for the completion of the work, sufficient to compensate for the delay, provided the contractor will notify immediately in writing of the cause in delay. If the contractor fails to complete the work in the specified time he shall refund to the city, the contracted liquidated damages and amount named in each of the proposals for the different portions of the work.

Before the work will be considered completed, all

rubbish and unused material due to, or connected with the construction, must be removed and the premises left in a condition satisfactory to the city. All sidewalks and crossings must be cleared up, streets, curbs, crosswalks, fences and other public and private property disturbed or damaged must be restored to their former condition, and final payment will be withheld until such work is finsihed.

Should any disagreement or difference arise as to the true meaning of the drawings or specifications at any point, or concerning the character of the work, the decision of the Engineer shall be final and conslusive, and binding on all parties to the contract.

The city reserves the right to increase or decrease the quantity of work, or any part thereof, to the amount found necessary. No allowance will be made, in case of increase, for any sum above the rate of price bid, nor in case of decrease for any real or supposed damage or loss of profit occasioned by such diminution. The time fixed for the completion of the work will be proportionately increased or diminished.

During unsuitable weather all work must stop when such work would be liable to be injured, and it must be suitably protected from any such possible injury.

No extra work will be paid for or allowed, unless the same is done upon the written order of the Engineer. Subject to this condition, extra work will be paid for according to the schedule of prices bid. Where prices for the work are not included in the schedule, ten per cent advance upon the

[illegible]

[illegible], must be removed and the ground so left in condition satisfactory to the city. All sidewalks and crossings must be cleaned up, streets, curbs, crosswalks, lawns and other public and private property disturbed or injured must be restored to their former condition, and final payment will be withheld until such work is finished.

Should any disagreement or difference arise as to the true meaning of the drawings or specifications or any part, or concerning the character of the work, the decision of the engineer shall be final and conclusive, and binding on all parties to the contract.

The city reserves the right to increase or decrease the quantity of work, or any part thereof, to the amount it may deem necessary. No allowance will be made, in case of increase, for any sum above the rate of price bid, nor in case of decrease for any real or supposed damage or loss of profit occasioned by such reduction. The time fixed for the completion of the work will be proportionately increased on [illegible].

[illegible] protected from any such possible injury.

The entire work will be paid for [illegible] done upon the [illegible] the engineer. [illegible] this condition, [illegible] work will [illegible] included in the schedule, [illegible]

actual cost, as determined by the Engineer will be paid to the contractor. All claims for extra work must be made in writing before the payment of the next succeeding estimate after the work shall have been performed. Any failure on the part of the contractor to make such claim will be a forfeit of the same.

All city, county or state laws, ordinances or regulations limiting or controlling the action or operation of those engaged upon the work or affecting the materials applied to them, must be respected or attended to.

The contractor will be required in his contract to preserve the city from all claims for damages, from any and all causes and nature whatsoever, in connection with his work or any part thereof, also to act as defendant in each and every suit of any and every nature which may be brought against the city by reason thereof, or connected with the work done under this contract.

Unless otherwise provided for in the details of specifications, the Engineer during the last week of each month, will make an approximate estimate of the value of the work done during that month, and the contractor will be paid the amount due under his contract on the fifteenth (15th) of the month following.

A final estimate of all work done and materials furnished according to the contract and these specifications, will be made as soon after the Engineer has been notified of the completion of the work, as he can satisfy himself by

[illegible] work, [illegible] the [illegible] will be [illegible] the [illegible] order. All of the [illegible] work [illegible] within [illegible] or [illegible] accounting [illegible] after the work shall have been performed. [illegible] the [illegible] and of the contractor to make such [illegible] [illegible] benefit of the [illegible].

All city, county, or State laws, orders or regulations limiting or controlling the nature or [illegible] of [illegible] upon the work or affecting the [illegible] [illegible] to [illegible], must be observed or complied to.

The contractor will be required in [illegible] to [illegible] the city from all claims for damages, from [illegible] and costs and [illegible], in connection [illegible] the work or by part thereof, also to [illegible] and every [illegible] of [illegible] and every [illegible] [illegible] the city, [illegible] thereof, or connected [illegible] [illegible].

[illegible] provided for in the [illegible] [illegible] [illegible], the [illegible] [illegible] [illegible] will make no approximate estimate of the value of the work done during that month, and the contractor will be [illegible] the month [illegible] on the [illegible] of the month following.

A final estimate of all work done [illegible] and according to the contract and [illegible] will be made [illegible] the [illegible] of the completion of the work, [illegible]

tests, examinations or otherwise, that the work has been and is finally and fully completed in accordance with the contract and specifications, and the contractor will be paid as hereinafter provided. Before such final payment will be made, the contractor must satisfy the city that all bills for labor and material used in the work have been paid.

The contractor will be furnished with one set of drawings, prints or tracings, and a set of specifications, giving all the details and dimensions necessary for carrying out his portion of the work. Dimensions given in figures will have preference over the scale where there is any discrepancy.

If the bidder does not fully understand the plans and specifications, or is in doubt as to the Engineer's ideas or intentions, concerning any part or portion of the work, he must satisfy himself by inquiry of the Engineer, before bidding, for he will be held rigidly to the Engineer's interpretation of the plans after the contract is drawn. The plans and specifications given are intended as complete, but should anything be omitted from them which is necessary to complete the work in accordance with the apparent intention of the Engineer, it will be supplied by the contractor, and at no extra cost to the city. Any work done by the contractor which is strictly extra work, will be settled for as above stated.

All materials, lines, grades, must be in full accordance with the plans, and no deviation from the plans and

[illegible]

[illegible] in accordance with the contract and specifications, and the contractor will be paid as herein then provided. Before such [illegible] payment will be made, the contractor must [illegible] bills for labor and material used in the work [illegible].

The contractor will be furnished with one set of drawings, prints or tracings, and a set of specifications, which he is to file and dimensions necessary for carrying out his portion of the work. Upon loss [illegible] will be prejudiced over the whole [illegible] observed.

If the job is done not fully understood by [illegible] conditions, or is in doubt as to the [illegible] or instructions, concerning any part or portion of the work, [illegible] immediately inform [illegible] for it will be held strictly to the [illegible] interpretation of the plans [illegible] contract [illegible] specifications [illegible] be [illegible] to complete the work in accordance with [illegible] and to [illegible] satisfaction, it will be supplied by the [illegible] the [illegible] contractor [illegible] [illegible] above [illegible].

[illegible]

specifications will be allowed, except by written authority of the Engineer and Water Works Committee.

The copy of plans and specifications furnished the contractor must be kept constantly at the work, be well cared for and returned to the Engineer when the work is completed.

The Engineer must stake out all the work and set all necessary grade-stakes; and the contractor is required to preserve all stakes bench-marks etc. set or established along the line of the work, until authorized to remove them. If moved by carelessness or without authority, they will be set if needed, at the expense of the contractor.

Each bid must be accompanied with a certified check or its equivalent, as a guaranty that the bidder will enter a contract with the city to do the work according to the plans and specifications, and for the amount of the bid. The amount of such check shall be five hundred dollars ($500).

This deposit will be retained and placed to the credit of the party whose bid is accepted, and will be forfeited if he fails to enter into and execute the contract awarded to him. In case the failure of the bidder to whom the contract is awarded, to sign the contract, the city reserves the right to accept any other bid made, and all checks will be held until contract is signed, when they will be returned.

As security for the proper performance of the work, a bond acceptable to the city of an amount up to one-fourth the amount of the contract will be required, and the city will pay at the times specified only eighty per cent (80%) of the monthly estimates of work properly performed and

materials delivered, after deducting all charges against the contractor, retaining the twenty per cent (20%) until the completion of the contract and the final acceptance of the work. Proposals must be enclosed in sealed envelopes and each must have written on it plainly the words, "Proposal for Water Works". Each proposal must be addressed to the Secretary of the Waterworks Committee of the city of Rushville, Illinois.

No proposal will be received after the limiting time fixed for receiving proposals, and no bidder will be allowed to withdraw his bid after it has been opened and read, unless the city fails to accept the bids for the work, within fifteen days (15) from the opening of the bids.

All work must be in strict accorance with the detail specifications under their appropriate headings, and the general and detail specifications will be attached to and made a part of each contract. The general specifications and conditions of agreement are to be considered a part of the detail specifications for each part of the work.

The final payment will be made within sixty (60) days after the formal acceptance of the work, by the Engineer and the city. Partial payments made upon the estimates, either monthly or otherwise, shall not be construed as a final or partial acceptance of any portion of the work, or as relieving the contractor in any way, from the responsibility herein contemplated. The right is reserved to reject any and all bids.

DETAILED SPECIFICATIONS

FOR

FURNISHING CAST IRON PIPE

AND

SPECIAL CASTINGS.

There will be required the following quantities of cast iron water pipe and special castings. The quantities herein given are approximate only and the city reserves the right to increase or decrease the quantities herein given without any extra expense to the city beyond the proportional increase of quantity.

2300	feet	of	12	inch	pipe	130.87 tons
7200	"	"	10	"	"	310.68 "
11225	"	"	8	"	"	346.29 "
46000	"	"	6	"	"	959.10 "
7200	"	"	4	"	"	72.00 "

Total Weight of cast iron water pipe 1818.94 short tons

SPECIAL CASTINGS.

Tee Branches.

2 - 12 x 12 x 12	1012 lbs	4 - 10 x 10 x 4	1244 lbs.
1 - 12 x 12 x 10	477 "	5 - 8 x 8 x 6	1075 "
1 - 12 x 12 x 8	460 "	1 - 8 x 8 x 4	206 "
2 - 12 x 12 x 6	888 "	12 - 6 x 6 x 6	2004 "
1 - 10 x 10 x 8	340 "	14 - 6 x 6 x 4	2156 "
5 - 10 x 10 x 6	1645 "	14 - 8 x 8 x 6	3010 "

Tee Branches (continued)

72 - 6 x 6 x 6 12024 lbs. 9 - 12 x 12 x 6 3996 lbs

Bends

1 - 6 inch - ¼ bend 101 lbs. 2 - 6 inch - ⅛ bends 186 lbs

1 - 12 " " " 287 " 1 - 8 " " " 121 "

1 12 " ⅛ " 238 "

Reducers.

1 - 12 to 10	256 lbs	5 - 8 to 6	620 lbs.
1 - 12 to 8	223 "	1 - 6 to 4	88 "
1 - 10 to 8	183 "	1 - 10 to 6	160 "

Cross Branches.

- 10 x 6	1515 lbs.	2 - 8 x 8	500 lbs
7 - 8 to 6	1470 "	7 - 6 x 6	1232 "
1 - 8 x 4	192 "	4 - 6 x 4	600 "
		2 - 6 x 4	300 "

Plugs.

1 - 10 inch	43 lbs.	14 - 6 inch	196 lbs
1 - 8 "	26 "	3 - 4 "	24 "

Wye Branches.

1 - 6 inch. 188 lbs.

Total weight of special castings 18.64 short tons

The pipes shall be of the kind usually known as "Hub and Spigot", and in general each straight pipe shall be about twelve (12) ~~inxxxx~~ in length from the bottom of the hub to the end of the spigot. The metal shall be of the best quality for the purpose, made from what is commercially known as "Neutral" Pig-Iron, which shall have been made from iron-ores without the admixture of cinder, and when cast into the pipe the metal shall be tough, and of such density and texture as will permit its being easily cut and drilled by

hand.

The city shall have the right to appoint an inspector whose duty it shall be to see that these specifications are strictly complied with; to reject any metal, mold or cast, which would, in his judgment, cause imperfection in the work, to supervise the coating, testing, and weighing of pipes and castings; to require at any time, specimen rods of the metal for testing, to reject after casting, any pipe or special casting which he may deem below the requisite standard of perfection and his decision and directions shall be respected and observed by the contractor.

Any palpable defect or imperfection which may have escaped the notice of the inspector, shall be deemed sufficient cause for rejecting any pipe or casting at any time previous ~~for the~~ to the final settlement and completion of the contract.

The pipe-metal must possess a minimum tensile strength of at least eighteen thousand (18,000) pounds per square inch. All the straight pipes shall be cast in dry sand mold, vertically, with the hub down. Every pipe is to have the initials of the maker's name cast distinctly upon it, and also the year, the class letter, and a number signifying the order of its casting, in point of date; the several different classes of pipe each to have its own series of numbering; the figures and letters to be at least two inches in length with a proportionate width; the weight of each pipe to be conspicuously painted on the outside, before delivery,

with white lead paint at the contractor's expense.

All special castings shall be subjected to the same examinations and tests at the foundry, except the water pressure test, as the straight pipe, and shall be marked in a similar manner. The Engineer may reject without proving, any pipe or casting which is not in conformity with these specifications.

Pipes and special castings shall not be taken from the pit and stripped while showing any color of heat, but shall be left in the flasks for a sufficient length of time to prevent unequal cooling and contraction by subsequent exposure.

On being removed from the flasks, all pipes and special castings shall be subjected to a careful examination and hammer tests for the purpose of detecting imperfections of any kind. They shall then be thoroughly dressed and made clear and free from earth, sand or dust, which adheres to the iron in the moulds; iron wire brushes must be used, as well as softer brushes to remove the loose dust. No acid shall be used in cleaning the castings. After having been properly dressed and cleaned, they shall again be subjected to a thorough inspection and hammer test. The contractor will be required at the foundry to place all castings in such positions as may be deemed necessary by the Engineer for convenience of inspection.

The pipes and special castings shall be free from scoria,

within this level point at the contractor's expense.

All special conditions shall be subjected to the satisfaction and tests of the Owner, except the water pressure test, on the air light pipe, no shall be tested in another manner. The Engineer may reject this if proving, any pipe or coating which is not in conformity with these specifications.

Pipes and special castings shall not be taken from the pit and stripped this showing any color or rust, but shall be left in the Trench for a sufficient length of time to prevent unequal cooling and contraction by subsequent expansion.

On being removed from the Trench, all pipes and castings shall be subjected to a careful examination and hammer tests for the purpose of detecting imperfections or any kind. They shall then be thoroughly cleaned and brought clear and free from earth, sand or dust, which adheres to the iron in the moulds; iron wire brushes must be used, and all other branches to remove the loose sand. The coat shall be used in cleaning the pipes. After having been properly dressed and cleaned, they shall undergo a thorough inspection and hammer test. The contractor will be required at his own to place all castings in such positions as may be deemed necessary by the Engineer for convenience of inspection.

The pipes and special castings shall be free from cracks,

sand-holes, air-bubbles and other defects or imperfections; they shall be truly cylindrical in the bore, straight in the axis of the straight pipes, and true to the required curvature or form in the axis of the other pipes; they shall be internally of the full specified diameters, and shall have their inner and outer surface concentric.

To insure proper diameter of sockets and spigots, a circular iron templet of the required dimensions shall be passed to the bottom of every socket, and a circular ring over every spigot. Care shall also be taken to avoid all excess in diameter of the sockets. No pipes or special castings will be accepted which are defective in joint room, whether in consequence of eccentricity of form or otherwise. No lump or rough places shall be left in the barrells or sockets, and no plugging or filling will be allowed. All pipes and special castings with defective hubs or flanges will be rejected.

After the above described cleaning and inspection, every pipe and special casting shall be heated, in a suitable oven, to a temperature of about 320 F., and while at this temperature, be immersed in a bath of hot coal tar pitch varnish, prepared in general, according to Dr. R. Angus Smith's process. Special care shall be taken to have the surface of all pipe and castings entirely clean and free from rust immediately before putting them in said bath. If any pipe or casting can not be dipped in said bath soon after its removal from the mould, it shall at once be thoroughly coated

[illegible]

[illegible] shall be [illegible] in the form, [illegible] in the [illegible] of the [illegible] pipes, and [illegible] to the [illegible] - [illegible] or [illegible] in the [illegible] of the [illegible] pipes, [illegible] shall [illegible] [illegible] of the [illegible] specified diameter, and [illegible] the [illegible] their inner and outer surfaces concentric.

To insure proper diameter of coolers and pipes, [illegible] iron tangent of the required diameter shall be pressed to the bottom of every cooler, and [illegible] [illegible] every pipe. This shall be done to avoid [illegible] - [illegible] in diameter of the coolers. No pipes or special [illegible] - [illegible] will be accepted which are defected in joint room, [illegible] in consequence of eccentricity of [illegible] [illegible]. No lump or [illegible] will be left in the interior of the coolers, and no plugging or filling will be allowed. All pipes [illegible] special conditions with defective lugs or [illegible] will be rejected.

After the above described cleaning and inspection, the pipe and special coolers shall be tested, in a [illegible] to a temperature of 300° F., and subjected to [illegible] - [illegible], as measured in [illegible] of cast iron pipes [illegible] prescribed in general, according to [illegible] - [illegible]. Special [illegible] shall be taken to insure the uniform [illegible] pipe and coolers [illegible] and after [illegible] - [illegible] only before [illegible] in [illegible]. [illegible] - [illegible] can not be dipped in [illegible] [illegible] - [illegible] from [illegible], [illegible] [illegible]

with pure linseed oil, in order to prevent the formation of any rust before applying the said varnish.

The coating must be durable, smooth, glossy, hard, tough, perfectly waterproof, and not affected by any salts or acids found in the soil, free from bubbles and blisters, strongly adhesive to the iron under all circumstances, and with no tendency to become soft enough to flow when to the sun in summer, or to become so brittle as to scale off in the winter.

After the said coating has become thoroughly set and hard every pipe shall be subjected to a proof by water pressure of three hundred (300) pounds per square inch. Each pipe while under the required pressure, shall be sharply rapped with a hand hammer, to ascertain whether any defects have been overlooked; and pipes which may exhibit any defects by leaking, sweating or otherwise, shall be rejected.

All pipes and castings must be delivered in all respects, sound and in conformity with these specifications. Upon their delivery at the point designated, the Water Works Committee reserves the right to subject any pipe or casting to the same water proof and hammer tests as are specified to be applied at the foundry; or which may have been broken in transportation, will be rejected when discovered, unless the same may be cut as hereinafter provided. Care must also be taken in handling the pipes and castings during transportation from the foundry to said point or any time after being coated. If, upon its arrival at the designated

point of delivery, the spigot end of any straight pipe should be found cracked or broken, during transportation from the foundry to the said point or otherwise, such defective portion shall be cut off at the contractor's expense, provided that the same does not exceed a length of four feet. A deduction from the proper original weight of such pipe shall also be made in each case, at the rate specified in the table of weight, for every inch of length so cut off. No pipe or special casting in which the hub is found to be cracked or defective in any respect will be accepted at said point of delivery or otherwise; nor will any special casting with a defective spigot end be received, or permitted to be cut off, without the written order of the Engineer.

Pipe arriving with the weight or number illegible or omitted will not be received, but will be subject to the same condition as cracked or broken pipe, so far as they apply.

All tools, men and materials required by the Engineer or the inspector in discharging their duties relative to the inspection at the foundry or otherwise, contemplated by these specifications, shall be furnished by the contractor, and at no expense to the City.

The right is reserved to reject any and all bids.

SPECIFICATIONS

FOR

FURNISHING HYDRANTS, VALVES,

VALVE-BOXES.

There will be required the following valves with valve-boxes to accord. The quantities here given are approximate only. Prices shall be submitted per piece.

One (1) twelve (12) inch gate vlave.

Four (4) ten (10) inch gate valves.

Nine (9) eight (8) inch gate valves.

Twenty-seve (27) six (6) inch gate valves.

One (1) four (4) inch gate valve.

The valves will be of the best quality made and of a design to be approved by the Engineer; they will be of the kind known as double-gate, double-hub, brass mounted. Bidders will state in their proposal what manufacture of gates they propose to furnish.

They must be what are termed "heavy" and must be tested successfully and remain water tight, under a pressure of three hundred (300) pounds per square inch at the factory.

The contractor will be required to guarantee their perfect condition for a period of six (6) months from the final acceptance of the work, and to pay all expenses and damages which may be incurred in keeping them in perfect order for that length of time.

[illegible]

[illegible]

[illegible]

[illegible]

There will be required the following valves [illegible] however to accept. The quantities [illegible] only. Prices will be submitted per piece.

One (1) twelve (12) inch gate valve.

Four (4) ten (10) inch gate valves.

Nine (9) eight (8) inch gate valves.

Twenty-seven (27) six (6) inch gate valves.

One (1) four (4) inch gate valve.

The valves will be of the best quality [illegible] and of a design to be approved by the Engineer; the [illegible] "Hand Iron or double-work, double-ring, screw mounted. [illegible] will state in their proposal [illegible] intended to be used for proposes to [illegible].

[illegible] "[illegible] and remain water tight, under a pressure of three hundred (300) pounds per square inch in the [illegible].

The contractor will be required to [illegible] within [illegible] contribution [illegible] period of [illegible] (3) months [illegible] the [illegible] of the work, and to pay all [illegible] and [illegible] which may be incurred in [illegible] in [illegible] order for the [illegible] of [illegible].

The valves will be made to open by turning the key to the left. They must be suitably coated.

The net area of water way must not be less than the net area of the pipe of the same nominal diameter, and in all particulars the valves must be of the best form and make, and proportioned for strength, durability and ease of working.

Defective valves will not be accepted, but will be stored, subject to the contractor's order and at his expense and risk.

The right is reserved to vary the number, kinds and sizes to such extent as may be necessary for the interest of the work.

Proposals must state the price per piece for each size, for use in case of increase or diminution in the quantities.

HYDRANTS.

Prices per piece will be submitted for one hundred (100) hydrants with six (6) inch bottom connections and two (2) two and one-half (2 1/2) inch nozzles. All bottom connection shall be standard and bell ends.

The hydrants must be of the very best quality made, and may be either the Matthews, Ludlow, Waterous, Chapman, Galvin, or other equally good make, acceptable to the Engineer. Bidders will state in their proposals what manufacture of hydrants they wish to furnish. They must be made of the best materials, such as will be durable and will insure perfect ease of motion for every moving part.

Bidders will specify the size of valve or gate openings and inside opening of stand pipe.

Bidders will submit prices for hydrants, with and without frost cases.

The character of the design must be such that all parts are easily accessible, and that repairs may be made at a minimum cost and at a very short time.

The drip must be such as will drain the hydrant perfectly, leaving no water standing in the stand pipe above the connecting pipe; such as will operate positively and certainly; so designed as to render it impossible to become clogged with anything liable to get into the water mains, or by roots; and such as will not easily get out of order or be difficult to repair.

The hydrants will be of proper length to use where the bottom of the pipe-trench is to be five (5) feet and six (6) inches below the surface grade. They will be designed to open to the left.

The nozzels will be cut with a thread to match the couplings now in use in the fire department of the city. The gate valve must be so designed as to operate easily and freely and not be liable to be clogged or stuck by small pieces of foreign matter, and must be made of or faced with a material which is durable and not easily injured, which will not be liable to stick to its seat, and such that any slight injury occur to the seat or gate face the valve will not leak.

Defective hydrants will not be accepted, but will be stored at the contractor's risk and expense and held subject to his order.

He will be required to guarantee the perfect working of hydrants for a period of six (6) months from the date of final settlement, and pay all expenses in damages which may be incurred in keeping them in perfect working order for that length of time.

All hydrants must be tested and stand satisfactorily, a pressure of three hundred (300) pounds per square inch at the factory.

VALVE BOXES.

Valve boxes will be required as hereinafter mentioned in the estimates and must be of a design acceptable to the Engineer.

Prices must be named per piece for the valve boxes to be set in mains laid in trenches varying in depth from four (4) feet six (6) inches to six (6) feet.

All valves after being set, must stand satisfactorily, the test specified for the mains after being laid, to-wit viz: a pressure of one hundred and fifty (150) pounds per square inch, as shown by a correct guage to be attached to a hydrant or hydrants in the city, at points to be designated by the Engineer and for such a length of time as the Engineer may desire, in order to satisfy himself of the perfections of the work.

The hydrant will be tested with the hydrant valve or

gate closed; also with the nozzel caps on and the gate or valve open, and each and every defect must be repaired, and at no expense to the city.

The proposal for furnishing hydrants, valves, and valve boxes, shall state the time for the full delivery of the materials under this specification. Other things equal, preference will be given to the proposal offering the earliest delivery.

The contractor, or contractors, will be required to contract to preserve and protect the city from all claims of infringement in the use of patent articles, and to defend any and all infringement suits brought against the city, growing out of, or due to the use of their hydrants, valves and valve boxes.

Drawings or models should accompany each bid.

During the last week of each month the Engineer will make an estimate of the amount of work done under the specification during that month. On the fifteenth (15th) of the succeeding month, the contractor will be paid eighty per cent (80%) of the amount due him on this estimate. The balance, twenty per cent (20%) will be due and payable within sixty (60) of the final completion and test and approval by the Engineer, and acceptance by the Water Works Committee.

The right is reserved to reject any and all bids.

[illegible] city.

The proposal for furnishing hydrants, valves, [illegible] covers, shall state the time for the full delivery of all goods under this specification. Other things equal, preference will be given to the proposal offering the earliest delivery.

The contractor, or contractors, will be required to contract to preserve and protect the city from all claims or infringement in the use of patent articles, and to defend any and all infringement suits brought against the city, growing out of, or due to the use of such hydrants, valves or valve boxes.

Drawings or models to accompany each bid.

During the first week of each month the Engineer will make an estimate of the amount of work done under the specification during that month. On the fifteenth (15th) of the succeeding month, the contractor will be paid eighty per cent (80%) of the amount due him on this estimate. The balance, twenty per cent (20%) will be due and payable within sixty (60) days of the final completion and test and approval by the engineer, and acceptance by the Water Works Committee.

[illegible]

SPECIFICATIONS FOR LAYING PIPE

AND

SETTING HYDRANTS, VALVES & VALVE BOXES.

The work under these specifications will include the laying of all water pipes except those contracted for in other contracts and otherwise specified, all necessary special castings in the pipe system throughout the city also all necessary valves and valve boxes.

The contractor will furnish all labor, materials and all plant necessary to lay the pipe in accordance with these specifications, and in a thoroughly first-class and workman-kind manner.

Any blow-off air cocks, or other connections necessary to render the work complete, will be set by the contractor at points to be designated by the Engineer.

The work will be done along such lines and streets as are indicated on the pipe distribution map of said water works system, and in such other places and streets in said city as may be directed by the city.

During each of the months of the time allowed for this work, a proportionate part of the work must be completed. Trenches for the pipes shall be opened under the direction of, and in accordance with the grades and lines to be given by the Engineer, and of such depth that the bottom of the trench shall be five feet and six inches below the grade of the street. Along the same street the pipe lines will be laid uniformly the same distance from the street center, in straight lines

and on straight uniform grades, between adjacent hydrants.

The greatest care must be exercised to insure public safety while the trenches are open, and until cause of danger appertaining to the work is removed by fencing, shoring, watching, lights, etc., and the contractor will be held liable for all damages due to neglect of these precautions.

The pipe will be laid in the order directed by the Engineer; and the storage of pipes and other materials on the streets, and the laying, must be so arranged as to cause the least possible interference with the public, and with the street, sidewalk and crossings.

In soft ground, each pipe must be laid on three blocks, two in. x eight in. x two ft. ,three for each pipe, laid equal distances apart.

Valves and hydrants, special castings, and all other appurtenances are to be placed at the places, and in the manner designated by the Engineer, specified herein and shown by the plans.

Any omission of branches, stop cocks or other appurtenances intended to be laid, shall be corrected when required, by reopening the trench, if it has been filled up, and introducing what may have been omitted and without extra charge on the part of the contractor.

In hard ground, the bed of the pipe must be even, true and uniform, so that the pipe will bear equally upon it for the whole of its length, and this result must be reached, either by carefully bottoming out the trenches, or by packing in and tamping solidly sufficient earth to bring it

The contractor [illegible] material to insure public safety while the trenches are open, and until [illegible] or appertaining to the work is removed by fencing, lighting, watching, lights, etc., and the contractor will be held liable for all damages due to neglect of these precautions.

The pipe will be laid in the order directed by the engineer, and the stores of pipe and other material, on the streets, and the laying, must be so arranged as to cause the least possible interference with the public, and with the street, sidewalk and crossings.

In soft ground, each pipe must be laid on two plank two in. by eight in. x two ft., three for each pipe, laid [illegible].

Valves and hydrants, special castings, and all other appurtenances are to be placed in the lines, and in the manner set forth by the engineer, [illegible] shown on the plans.

Any omission of hydrants, stop-cocks or other appurtenances intended to be laid, shall be corrected and repaired, by reopening the trench, if it has been filled in, and introducing what may have been omitted and [illegible] charge on the part of the contractor.

In hard ground, the bottom of the pipe trench shall be [illegible] and uniform, so that the pipe will bear equally upon it for the whole of its length, and this result must be attained, either by carefully bottoming out the trenches, or by puddling in sand or clay, sufficiently [illegible]

to the proper grade. Sufficiently large holes shall be dug, to leave the bell of each pipe free, and not resting on the ground at any point.

At the time of laying, the bells and spigots shall be truly adjusted so as to give a uniform lead space all around, and the depth of lead must not be less than two (2) inches, but must be more if necessary, in order to completely fill the rabbet in the hub or bell end of pipe.

The lead must be of the best quality, pure and soft, and must be calked securely and properly into place.

The gasket must be of clean hemp yearn or oakum, twisted and rammed tightly into place. Before making the joint, the bell and spigot must be wiped clean and dry, and the joint run at one poring. The calking must be faithfully executed, and the lead driven flush with the face of the work or until it will set no further.

The pipes are to be swept clean and free from dirt and rubbish before laying, and each time of stopping work the end of the pipe line must be carefully plugged and closed to exclude animals, dirt and water.

All streets and sidewalks, crossings, public or private grounds shall be restored to their former and original condition the same as before work was commenced, and in every way satisfactory to the Engineer.

Great care must be taken not to remove without the consent of the proper parties, any gas pipes, water pipes, sewers, drains or cisterns, or their appurtenances, and they must be carefully shored up, supported and protected, and the pipe laid in such a way as not to harm them. After

o lower [illegible] half of each [illegible], and [illegible] ground at [illegible] joint.

In the act of laying, the bell and spigot shall be truly adjusted so as to give a uniform lead space all around, and the depth of lead shall not be less than one (1) inch, but may be more if necessary, in order to completely fill the rabbet in the hub or bell end of pipe.

The lead must be of the best quality, pure and soft, and must be [illegible] [illegible] tightly into place.

The gasket must be of clean hemp, yarn or oakum, twisted and rammed tightly into place. [illegible] joint, the bell and spigot must be wiped clean [illegible] the joint run at one pouring. The caulking [illegible] completed, and the lead [illegible] flush with the face of the [illegible] or [illegible] flush with the [illegible].

The pipe must be kept clean and free from mud and rubbish before laying, and each time of stopping work the end of the pipe line must be carefully plugged or closed to exclude animals, dirt and water.

All streets, sidewalks, crossings, [illegible] or [illegible] grounds shall be restored to their former [illegible] condition the same as before work was commenced, and [illegible] [illegible] satisfactory to the engineer.

Great care must be taken not to [illegible] conduits of [illegible], and [illegible] pipes, [illegible] sewers, drains or [illegible], or [illegible] [illegible] [illegible] [illegible] the pipe laid [illegible]

passing the above with the pipe, the earth must be very carefully compacted about them. Any damage done to any of the above, or any other public or private property, must be made good by the contractor.

If any boulders be encountered in the trench, they must be taken out and removed off the streets, or if sunk so that the tops will not be less than one foot below the bottom of the pipe. No stone larger than one man can lift will be put back in the trench.

Whenever necessary to cross under, or in any manner interfere with the railroad, due notice shall be given to the superintendent of the same, and a crossing must not be made except with his approval as to time and manner.

In back-filling the trenches, the earth must be rammed carefully under and around the pipe up to its center, the rest of the trench may then be filled by depositing the earth in layers not to exceed six (6) inches in thickness and ramming each layer thoroughly. No boulders will be allowed in back-filling within two (2) feet of the top of the pipe.

In opening the trenches, the surface of the street, if of good gravel or macadam, shall be carefully removed and deposited by itself on one side of the trench, and in back-filling the surface of the street must be returned to its original condition. Any extra material necessary for this purpose, must be provided by the contractor at his own expense.

All unused or defective material, rubbish etc., in-

[illegible]

[illegible] above, or any other public or private property, must be made good by the person doing the [illegible].

If any boulders are encountered in the trench, they must be taken out and removed out of the trench, or if a rock is in the way, it may be left, but the top of the pipe must be lower than the rock below the top of the pipe. No stone larger than one man can lift will be put back in the trench.

Whenever necessary to cross under, or in any manner interfere with the railroad, one notice shall be given to the superintendent of the road, and a crossing permit made except from the approval and to time and manner.

In back-filling the trenches, the earth must be rammed carefully under and around the pipe up to the center, the rest of the trench may then be filled by depositing the earth in layers not to exceed six (6) inches in thickness and ramming each layer carefully. No boulders will be allowed in back-filling within two (2) feet of the top of the pipe.

In opening the trenches, the surface of the earth, if of good gravel or sod, shall be carefully removed and deposited by itself on one side of the trench, and the back-filling in the surface of the trench [illegible] the original condition. The [illegible] necessary for this purpose, must be provided by the contractor [illegible].

All dirt or rubbish [illegible], [illegible]

(in-)
cident to the work, must be removed at once, and the street kept clean. All pieces of pipe not shorter than three (3) feet must be used at once in the line; that which can not be used must be removed at once to a place designated by the Engineer.

Whenever these requirements or any portion of them are unheeded or neglected the Engineer will give the contractor due notice to that effect, and if the rubbish etc., is not removed, or the needed repairs made, the Engineer shall have power to employ men to do such work at the expense of the contractor, and these expenses may be deducted from any moneys due him from the city.

The contractor shall maintain the pipe system in perfect order for a period of six (6) months from the time of its final acceptance by the city, and shall repair at his own expense all breaks, leaks and faults, which occur in his work, by reason of faulty material, or faulty workmanship, and shall pay all damages resulting therefrom. During this time, he shall maintain the surfaces of the streets, in their original undisturbed condition.

Pipe laid, will be measured from center to center of special castings on cross lines, or from center of special castings to end of line, and from center of main to center of hydrants.

Where specials are inserted and plugged, measurements will be made to the end of the branch.

[illegible] to the work, and is measured at [illegible], and [illegible] [illegible] place. All pipes of the [illegible] [illegible] [illegible] must be used as once in one line; that [illegible] [illegible] be used that by removed or once in a place designated by the [illegible].

Whenever there requirements or any portion of them are [illegible] or replaced the engineer will give the contractor the notice to that effect, and if the [illegible] are removed, if the used pipeline made, the contractor shall have power to employ men to do such work at the expense of the contractor, and the expenses may be deducted from any moneys due him from the city.

The contractor shall maintain the pipe system in perfect and [illegible] for a period of six (6) months from the time of the final acceptance by the city, and shall repair at his own expense all breaks, leaks and faults, which occur in his work, by reason of faulty material, or faulty workmanship, and shall pay all damages resulting therefrom. With such time, he shall maintain the surface of the street, in their original unbroken condition.

Pipe lines will be measured from center to center of special crossing on cross lines, or from center of [illegible] [illegible] to end of line, and from center of [illegible] to center of [illegible].

[illegible] speed in [illegible] and [illegible], measurements will be made to the one of the [illegible].

HYDRANTS.

All hydrants will be carefully examined by the contractors to see that they are in perfect working order and free from rubbish, dirt, stones, etc., before setting them, and when defects exist he must call the Engineer's attention to the fact.

The trench to receive the hydrants will, in clay, open, porous, sandy or gravely soil, be excavated of sufficient size, and at least one-quarter of a yard of coarse gravel or broken stone shall be placed beneath and around the hydrants, up to a point one (1) foot above the drip; then the earth shall be tamped securely to the surface. In sandy or gravely ground, enough broken stone shall be placed about the drip to keep it free from clogging.

The foot of the hydrant shall be securely braced behind, to prevent injury to the bottom joint, and care must be taken to set the hydrants truly vertical. Each hydrant will be set truly at grade and will stand upon a flat stone or upon a piece of plank, 2 in. x 12 in. x 12 in.

SETTING VALVES.

The contractor will examine all valves carefully, and all found defects must be rejected. Care will be taken to see that all the dome and packing-gland nuts are set up tight and properly.

All valves will be set uniformly with reference to property or curb lines, as directed by the Engineer, and no variation greater than one (1) foot from the uniform location,

[illegible]

All hydrants will be carefully examined by the contractor to see that they are in perfect working order and free from rubbish, dirt, stones, etc., before setting them, and when defects exist he must call the Inspector's attention to the fact.

The trench to receive the hydrants will, in clay, open, porous, sandy or gravelly soil, be excavated of sufficient size, and a level one-quarter of a yard of coarse gravel or broken stone shall be placed beneath and around the hydrant, up to a point one (1) foot below the drip; then the earth shall be tamped securely to the surface. In sandy or gravelly ground, enough broken stone shall be placed about the drip to keep it free from clogging.

The foot of the hydrant shall be securely braced against to prevent injury to the bottom joint, and care must be taken to set the hydrants truly vertical. Each hydrant will be set truly at grade and will stand upon a flat stone or upon a piece of pipe, 9 in. x 12 in. x 12 in.

[illegible]

The contractor will examine all valves carefully, and all found defects must be rejected. Care will be taken to see that all the domestic and private connections are set and properly.

All valves will be set upright, with reference to [illegible] or curb lines, as directed by the Inspector, and [illegible] on each side of them one (1) foot from the [illegible]

will be permitted.

The prices must include the setting of all hydrants, valves, valve-boxes, etc.

The proposal for laying cast iron pipe, special castings, etc., shall state the time for the full completion of the work, as per this specification. Other things equal, preference will be given to the proposal offering the earliest completion of the work .

The right is reserved to reject any and all bids.

will be permitted.

The bidder must include the cost of all gates, valves, valve-boxes, etc.

The proposal for laying cast iron pipe, special castings, etc., shall state the time for the full completion of the work, as per this specification. Other things equal, preference will be given to the proposal offering the earliest completion of the work.

The right is reserved to reject any and all bids.

SPECIFICATIONS FOR FURNISHING

AND

SETTING UP PUMPING MACHINERY.

The pumps may be of any standard and reputable make such as the Worthington, Laidlow, Dunn, Gordon, Hughes, or other manufacturer equally acceptable and approved by the Engineer. Bidders shall state in their proposal what manufacture they propose to furnish.

The pumping system shall consist of two twin duplex pumps capable of pumping one million one hundred thousand (1,100,000) gallons of water in ten hours against a head of two hundred and thirty (230) feet and a suction lift of eighteen (18) feet.

The pump guages shall be of a make acceptable to the Engineer and shall be mounted on a neat walnut board at such place in the engine room as the Engineer shall direct.

Each pump shall be furnished with a reliable engine counter connected to the rocker, to record the strokes.

The proposal must give a lump sum for furnishing all materials and labor of whatever kind or description, for the complete construction, delivery and erection complete with all appurtenances and with foundations for two (2) pumping machines together with the suction pipes from the pumps to the water supplies. The contractor is required to furnish the masonry for the foundation which shall be of a kind approved by the Engineer .

Bidders shall submit with their proposals detailed

SPECIFICATIONS FOR DEEP WELL PUMPING MACHINERY.

The pumps may be of any standard and reputable make such as the Worthington, Laidlow, Dunn, Gordon, Mather, or other equal other equally acceptable and approved by the Engineer. Bidders shall state in their proposal such makes they propose to furnish.

The pumping system shall consist of two twin duplex pumps capable of pumping one million one hundred thousand (1,100,000) gallons of water in ten hours against a head of two hundred and thirty (230) feet and a suction lift of eighteen (18) feet.

The pump power shall be of a make acceptable to the Engineer and shall be mounted on a steel walnut board at such place in the engine room as the Engineer shall direct.

Each pump shall be furnished with a reliable counter counter connected to the rocker, to record the strokes.

The proposal must give a lump sum for furnishing all materials, the labor of whatever kind or description, for the complete construction, delivery and erection complete of all appurtenances and with foundations for two (2) pumping machines together with the suction pipe from the pumps to the water cylinder. The counter is required to furnish the necessary for the foundation which shall be approved by the Engineer.

Bidders shall submit with their proposals certificate

drawings of the foundations of the machine that they propose to furnish.

In submitting proposals for the materials and the work to be done under this specification bidders will state the time required for the complete delivery and erection of the plant. Other factors being equal preference will be given to that proposal offering the earliest delivery and erection of the work.

The right is reserved to reject any and all bids.

[illegible] proposals [illegible]

[illegible]

In submitting proposals for [illegible] work to be done under this specification bidders will state the time required for the complete delivery and erection of the plant. Other factors being equal preference will be given to that proposal offering the earliest delivery and erection of the work.

The right is reserved to reject any and all bids.

SPECIFICATIONS FOR FURNISHING

AND

SETTING BOILERS, HEATERS, FEED PUMP, ETC.

The contractor shall furnish and erect the stack connection to chimney. It shall be made of iron not thinner than number ten B. G. with damper for each boiler.

The boiler shall be set in independent furnaces upon the space marked in the plan of Pumping Station and must conform as nearly as possible to the plan of "Boilers and Boiler Setting", on file in the office of the Water Works Committee.

The contractor shall furnish a full set of drawings showing all parts of the boilers as they will be erected, together with piping, foundations, etc., which shall be approved by the Engineer.

The entire lining of of all walls, arches and flues exposed to the direct action of the heat shall be made of four (4) inches of fire brick laid in fire clay.

The workmanship throughout boilers, both in construction and erection shall be of the best, and any part of the plant, however perfect in other respects, if faulty as regards workmanship, will not be accepted.

All unfinished parts of the boilers, and all pipes, shall have two (2) coats of good paint of such color as the Engineer may select.

All parts of the machinery shall be protected from the rust and erosion during erection. (43)

[illegible]

The contractor shall furnish and erect the [illegible] medium to chimney. It shall be made of iron not [illegible] than number ten (. [illegible] with damper for each boiler.

The boiler shall be set in independent [illegible] as specified in the plan of Heating Station and [illegible] conform in detail, as possible to the plan of "Boilers [illegible] Boiler Setting", on file in the office of the [illegible] [illegible].

The contractor shall furnish a full set of drawing [illegible] ing all parts of the boiler as they will be erected, [illegible] er with piping, foundations, etc., which shall be approved [illegible] the Engineer.

The entire lining of of all walls, arches and floor supported to the direct action of the fuel shall be made of [illegible] to r (1) inches of fire brick laid in fire clay.

The mechanically throughout boiler, both in construction and erection shall be of the best, and any part of the plant, however partial, in other respect, if lacking in requisite workmanship, will not be accepted.

All unfinished parts of the boilers, and all pipes, shall have two (2) coats of good paint of [illegible] color [illegible] manufacturer may select.

All parts of the machinery shall be protected from [illegible] by a suitable lining protection. (18)

The boilers shall be insured for one year, the papers to be made out in the name of the city by some good and reliable insurance company and at the expense of the contractor.

Great care must be taken to preserve the true form and dimensions of the boilers, and in flanging, not to crack or injure the sheets; no cracked or ragged flanges will be accepted; flanges are to be machine turned.

All steam and hot water pipes in the engine and boiler room, shall, be covered with plastic asbestos or mineral wool and striped with duck sewed in place, or with removable hair felt or magnesia covering and painted, to the approval of the Enginaer.

Steam for the supply of the boiler feed pump, shall be taken from the steam domes by independent connections with stop valves to disconnect either pipe from dome.

The boilers shall be connected to be filled by the boiler feed pump from hot well, with the necessary connection for steam hose, for steam flue cleaner etc.

The suction of the boiler feed pump shall be connected with the discharge main, and the discharge of feed pump will be connected with boilers.

There will be placed on the steam pump, a live steam separator. This separator shall be of the vertical pattern and the drip pipe shall be connected to sewer, so that the impurities and condensation shall be discharged therein.

All stop and regulating valves required for the control of the steam, exhaust and water connection, shall be included in the proposal.

All stop valves (except blow-off valves) either called

for or implied in this specification shall be valves of make acceptable to the Engineer. All valves of three (3) inches diameter of connection, and larger shall be of iron bodies with brass mounting, and all smaller valves shall be entirely of brass. The blow-off valves may be globe valves of brass. The steam valves over the dome of the boilers, and stop-valves in the suction and discharge connections or pumps, shall be flanged valves. All valves of four (4) inches and larger diameter shall be flanged valves.

The general plans in the office of the Water Works Committee, showing location of boilers, pumps, etc., shall be strictly adhered to in the location, arrangement, and dimensions of boiler, smoke connections, pumping engines, suction and discharge water pipes and valves, feed pump, steam and exhaust, and feed water and blow-off valves and pipes; and no proposal will be formal which requires changes in the dimensions of engine room or boiler room, or in the position of the suction and discharge main or chimney.

Proposals under this specification will be held to include all materials, tools, labor and transportation necessary or incidental to the completion of the within described machinery, all and singular, ready for daily service in the pumping station of the Rushville Water Works, including masonry foundations for boilers above referred to.

It is the purpose of this specification to hold the contractor responsible for all risks of every nature involved in the construction, and above mentioned tests of his machinery, and for all delays occasioned by defective or

not be limited to [illegible] made acceptable to the Engineers. All valves two (2) inches diam. [illegible] of connection, and larger shall have iron bodies with brass mounting, and all smaller valves shall be entirely of brass. The blow-off valves [illegible] of brass. The steam valves over the dome of the boilers, and stop-valves in the suction and discharge connections or pumps, shall be flanged valves. All valves of two (2) inches and larger diameter shall be flanged valves.

The general plans in the office of the Water Works Committee, showing location of boilers, pumps, etc., will be strictly adhered to in the location, arrangement, and dimensions of boiler, smoke connections, pumping engines, suction and discharge water pipes and mains, feed pumps, steam and exhaust, and feed water and blow-off valves and pipes; and no proposal will be considered that requires changes in the dimensions of engine room or boiler room, or in the position of the suction and discharge mains or chimney.

Proposals under these specifications will be held to include all materials, tools, labor, [illegible] cessary or incidental to the completion of the [illegible] machinery, all [illegible] the [illegible] economy [illegible]

It [illegible] contractor responsible [illegible] volved in [illegible] construction, and above [illegible] the machinery, [illegible]

incomplete work.

The machinery as a whole, and all the details and trimmings, shall be subject to the approval of the Engineer, and such parts as may be rejected shall be promptly replaced with other parts which are satisfactory, at the cost of the contractor, and without delay to the work.

The custody of the machinery will be with the contractor until it has been started, tested and accepted for service by the Engineer, and any damage or injury sustained by the machinery previous to acceptance for service must be repaired at the cost of the contractor.

Every proposal must definitely state the time within which the work herein contemplated will be completed after an award of contract. Said time to include all delays and hindrances whatsoever. Other things being equal, preference will be given the proposal offering the earliest completion of the work.

The right is reserved to reject any and all bids.

[illegible] work.

The machinery or tools, or all or any of the machinery, shall be subject to the approval of the inspector, and such parts as may be rejected shall be promptly replaced by the contractor with parts which are satisfactory, at the cost of the contractor, and without delay to the work.

The cooling of the machinery shall be at the sole risk of the contractor, and if it has been at rest, heated and consequently injured by the weather, any damage or injury sustained by the machinery prevents the proper service for which it is intended at the cost of the contractor.

Any proposed work contrary to the plans, or in addition to the work herein contemplated, will be completed only by order of contract. Care must be taken to include all delays and [illegible]. [illegible] will be given the proposed additions to modify the condition of the work.

The right is reserved to reject any and all bids.

SPECIFICATIONS FOR PUMPING STATION

AND CHIMNEY.

The building of pumping station will include the excavation for foundations and construction of pumping station and chimney, in accordance with the plans and specifications and their express and implied intentions.

The bottom of the trench for the footing course shall be excavated truly level and rammed so as to provide an even bearing over its entire surface.

All brick used in the construction of the building shall be good merchantable brick, of uniform size and color, and with sharp edges. They shall be laid in good, well slacked lime mortar, they will be laid truly to line and with one-quarter (1/4) inch joints; five courses of stretchers to one of headers. All joints must be well filled with mortar and each brick well bedded.

In the engine and boiler rooms, the brick work must be truly to line on the inside of the wall; the surface and joints must be filled full of mortar, (and the surface rubbed smooth).

All outside doors of building will be provided with cut stone sills, and not less than six (6) inches thick, and of the same width as the walls. All windows will be provided with cut stone sills not less than four (4) inches thick and six (6) inches wide. All openings for doors and

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The building of pumping station will include the construction for foundations and construction of pumping station and only, in accordance [illegible] plans and specifications [illegible] and their express and implied intentions.

The bottom of the trench for the footing course shall be excavated fully level and trimmed to [illegible] to provide [illegible] bearing over its entire surface.

All brick used in the construction of the building [illegible] be good merchantable brick, of uniform size and color, and with sharp edges. They shall be laid in good, well [illegible] lime mortar. They shall be laid truly to lines and [illegible] one-quarter (1/4) inch joints. The course of brickwork [illegible] be of a depth [illegible] will be well filled with mortar. No [illegible] brick shall be laid.

In the pumping and [illegible] room, the brick [illegible] be laid to lines on the inside of the wall; [illegible] joints [illegible] filled with mortar, [illegible].

All [illegible] door [illegible] will be provided [illegible] and [illegible] shall [illegible] (1) [illegible] and of [illegible] shall [illegible] provided [illegible] (2) [illegible] shall [illegible] (3) [illegible]

windows shall be arched.

The brick work shall be carried up between the rafters and on the level with the top of same. A wall plate 2 x 8 inches shall be laid on top of the brick work and anchored securely. The rafters, ceiling joists and tie beams in the boiler room shall be surfaced, and all joints accurately made so as to present a neat appearance.

Over the center of the boiler room shall be placed a galvanized iron ventilator of an approved design, not less than twenty-four (24) inches in diameter.

There shall be provided a number three eight (8) inch whistle (single bell chime). Connections to this whistle shall be two inch pipe, and be so connected that steam can be used from either boiler. The whistle shall be set about six (6) feet above the roof.

All doors and windows shall be of size shown on the plans. The materials for the doors shall be of the best quality, one and three-fourths (1 3/4) inches thick. The door frames shall be made of two (2) inch stuff, thoroughly seasoned and not less than eight (8) inches wide, except for double doors for pump room which shall two by twelve inches. They shall be securely set and firmly fastened to blocks laid in the walls.

There shall be provided a suitable trap door with hinges and ring, placed in the floor to give access to the pipe and fittings beneath.

The joists overhead in the engine room shall be lathed and plastered with adamant in a manner acceptable to the Water works Committee.

[illegible] be [illegible].

[illegible] [illegible] up between [illegible] on the level [illegible] of [illegible]. [illegible] 2 x [illegible] shall be laid on top of the brick [illegible] horizontally. The [illegible], ceiling joists and the beam in the boiler room shall be welded, and all joints [illegible] made so as to present a neat appearance.

Over the center of the boiler room shall be placed a galvanized iron ventilator of approved design, not less than twenty-four (24) inches in diameter.

There shall be provided a number [illegible] sixty (60) inch [illegible] (adjacent wall [illegible]). Connections to [illegible] shall be two inch pipe, and be so connected that steam may be [illegible] from either boiler. [illegible] shall be [illegible] about six (6) feet above the roof.

All doors and windows shall be of size shown on the plans. [illegible] shall be of the best [illegible] quality, [illegible] three-ply [illegible] (1 3/4) inches thick. The door [illegible] shall be [illegible] two (2) inch [illegible], [illegible] [illegible] and not less than six-six (6) inch [illegible], except [illegible] doors for [illegible] which shall be twelve inches. They shall be [illegible] [illegible] shall [illegible] to [illegible] in the [illegible].

There [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], place in the [illegible] to [illegible] [illegible] [illegible].

The joists [illegible] in the main [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

All woodwork shall be painted three (3) coats, lead in oil; colors to be selected.

The soil under engine room floor shall be excavated to a depth sufficient to give three (3) feet in the clear between the bottom of joists and ground, and all dirt thus excavated not needed for grading around same, shall be neatly graded around power house as directed by the Water Works Committee.

Provisions shall be made in walls and roof for all pipes, blow-offs, etc. Provisions shall be made in boiler room for flue connection from boilers to chimney. Provisions shall be made in foundation for suction and discharge mains; provision shall be made for a sewer to run outside of building at such place as may be designated by the Water Works Committee.

CHIMNEY.

There shall be built of brick, a smoke stack sixty (60) feet high and forty-two (42) inches inside diameter. This stack shall be built of a good quality of hard burned brick laid in cement mortar consisting of one (1) part of Louisville cement (or its equivalent) to three (3) parts of clean, sharp sand, and shall be lined with fire brick at least four (4) feet above opening for breaching. The opening for the breaching or smoke connection shall be arched. There shall be an iron ash door with suitable frame placed at the base of the stack. The top of the stack shall be capped with a cast iron plate not less than one (1) inch thick. The foundation shall be of concrete of a standard

All woodwork shall be painted three (3) coats, lead
in oil; colors to be selected.

The wall under sinks and floor of all bathrooms should be
[illegible] with [illegible] to three feet (3) [illegible] in [illegible]
[illegible] the interior of toilets and rooms, and all other [illegible]
unoccupied not heated or standing around rooms, shall be [illegible]
[illegible] round power house or directed by the [illegible] [illegible]
committee.

Front lons shall be [illegible] wall [illegible] floor for all [illegible],
[illegible]-office, etc. Provisions shall [illegible] in boiler room
[illegible] line connection [illegible] to chimney. Front door
shall be made in [illegible] for [illegible] [illegible]
protection [illegible] to [illegible] [illegible]
[illegible] and plans [illegible] determined by the [illegible]
[illegible].

[illegible]

There shall be built of brick, [illegible] stories of [illegible] [illegible]
(20') feet high and for [illegible]-two (32) inches in inside diameter.
This stack shall be built of a good quality of [illegible] [illegible]
brick laid in cement mortar consisting of one (1) part of
Portland cement (or its equivalent) to three (3) parts of
clean, sharp sand, and shall be lined with [illegible] [illegible]
lined for (4) feet above opening for [illegible]. The open-
ing for the [illegible] or smoke connection shall be [illegible].
There shall be an iron cast door [illegible] [illegible] [illegible]
[illegible] of the stack. The top of the stack shall [illegible]
[illegible] cast iron plate not [illegible] than one (1) inch
[illegible]. The connection shall be [illegible] [illegible]

(10)

mixture for such cases and approved by the engineer.

The contractor shall furnish all transportation, material and workmanship necessary and incidental to the proper carrying out of the work, embraced under this specification and the proposal shall be for the work complete including all excavations, foundation, etc. All materials, cement and sand and all workmanship, shall be subject to the approval of the engineer; and all material and workmanship which may be rejected shall be promptly removed from the grounds and replaced with satisfactory material and workmanship at the cost of the contractor, and without delay in the completion of the work.

The plans referred to in this specification shall be understood to mean the drawings especially prepared for this work on file in the office of the Water Works Committee. Any additional drawings that may be necessary to the proper understanding of the work embraced under this specification will be furnished by the engineer upon application.

Proposals shall state the time for the delivery of the materials and completion of the work under this specification. Other things equal, preference will be given to the proposal offering the earliest completion of the work.

The contractor will be required to forfeit as confessed and liquidated damages to the city, the sum of Fifteen (15) Dollars per day, for each and every day the final delivery and erection is delayed beyond the time specified in his proposal, and he will be required to reimburse said city for any and all damages and increased costs of the

[illegible] of the engineer.

The contractor shall furnish, if requested by the [illegible] [illegible] necessary, the labor and [illegible] [illegible] [illegible] work, whenever ordered by the [illegible] [illegible] and the proposal shall be for the work complete including all overhead, [illegible] modification, etc. All materials, equipment and [illegible] work complete, shall be subject to the approval of the engineer; and if rejected the contractor shall be promptly removed from the premises and replaced with satisfactory material and workmanship at the cost of the contractor. [illegible] in the completion of the work.

The plans referred to in the specification shall be understood to mean the drawings specially prepared for this work on file in the office of the Water Work Board. No additional drawings shall be necessary to the proper understanding of the work embraced under the specification [illegible] by the engineer upon specification.

Proposals shall state the time for the delivery of the materials and completion of the work under this specification. Other things equal, preference shall be given to the proposal of the most satisfactory completion of the work.

The contractor will be required to furnish a complete and finished drawing to the city, for the [illegible] [illegible] (10) dollars per day, for each and every day [illegible] delivery and erection [illegible] beyond the time [illegible] in his proposal, and [illegible] to [illegible] said [illegible] [illegible] [illegible] [illegible]

work to the city by reason of such delay, and to act as defendant in any and all suits which may be brought against the city by reason of such delay, or from any other cause connected with his or their contract with the city.

During the last week of each month, the Engineer will make an estimate of the materials furnished and the work completed under this specification during that month; eighty (80) per cent of the amount due will be paid upon the fifteenth (15th) of the succeeding month. The balance twenty per cent (20%) will be due and payable within sixty (60) days of final completion and tests and approval by the Engineer and accepted by the Water Works Committee.

The right is reserved to reject any and all bids.

work to the city by reason of such delay, and to pay a deduct in any and all extra costs that may be incurred by the city by reason of such delay, or from any other cause connected with his or their contract with the city.

Within the last week of each month, the engineer will make an estimate of the materials furnished and the work completed under this specification during that month; eighty (80) per cent of the amount due will be paid upon the fifteenth (15th) of the succeeding month. The balance twenty per cent (20%) will be due and payable within ninety (90) days of final completion and taken and approved by the engineer and accepted by the Public Works Committee.

The right is reserved to reject any and all bids.

SPECIFICATIONS

FOR

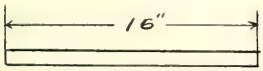
WATER WORKS, TANK AND TOWER FOR

RUSHVILLE, ILLINOIS.

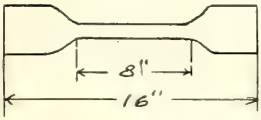
TANK SPECIFICATIONS (general).

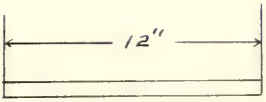
The metal composing the tank shall be soft, open-hearth steel, containing not more than 0.06 per cent phosphorus, and having an ultimate strength of not less than 54,000, nor more than 62,000 pounds per square inch, and elastic limit of not less than 30,000 pounds per square inch, and a structure which shall be silky in character. Before or after being heated to a cherry red and quenched in water at 80 F. the steel shall admit of bending while cold, flat upon itself, without sign of rupture on the outside of the bent portion.

All test samples shall be cut from finished material.



Tensile Test Piece
Area = ½ sq. in.





Bending Test Piece
Width = 4 x thickness

Tensile test pieces to be at least 16 in. long, and to have for a length of eight (8) inches an uniform plained-edge, sectional area of at least one-half (1/2) square inch, the width in no case to be less than the thickness of the piece. Bending test pieces are to be twelve (12) inches long, and to have a width of not less than four times the thickness, with edges filed smooth. If required by the Engineer, the contractor will provide four (4) certified samples of each thickness of plate used in the work, these samples to be two (2) inches wide and sixteen (16) inches long.

For the purpose of identification the number of the melt or heat of steel shall be stamped on each plate produced therefrom. At least one full set of tests, both chemical and physical, as above specified, shall be made of each melt, and such additional tests may be made as, in the judgment of the inspector, seem essential for corrobative purposes under varying conditions or methods of treatment of the metal. All plates must be free from laminations and surface defects, and shall be rolled truly to the specified thicknesses. Complete facilities for the tests and inspections shall be provided by the contractor, as required. Material may be inspected at the mill by such party as may be approved by the Water Works Committee of the city of Rushville, Illinois.

The plates and angles shall be shaped to the proper curvature by cold rolling. No heating and hammering shall be allowed for straightening or curving, and no scarfing shall

be done at a temperature below that of ignition of a hard-wood hammer handle, and no work shall be done upon the steel between such temperature and that of boiling water.

The work shall be carefully and accurately laid out in the shop and the rivet holes punched with a center punch, sharp and in perfect order, from the surface to be in contact. The diameter of the punch shall not exceed that of the rivet by more than one-sixteenth (1/16th) inch, and the diameter of the die shall in no case exceed that of the punch by more than one-sixteenth (1/16th) inch. Rivet holes in plates having a thickness of three-fourths (3/4th) inch and over, shall either be drilled, or if punched, shall be reamed not less than one-eighth (1/8) inch larger than the die size of the holes and sharp edges shall be trimmed.

All calking edges shall be planed to a proper bevel. All parts must be adjusted to a perfect fit, and properly marked before leaving the shop.

In assembling the work the rivet holes shall match so that hot rivets may be inserted without the use of a hammer. The use of the drift pin will not be permitted. Eccentric holes, if any, must be reamed, and if required, larger-sized rivets shall be used in such holes.

The best grade of soft charcoal iron rivets to be had in the market shall be used. Sufficient stock must be provided on the rivets to completely fill the holes and make a full head. The rivets shall be driven at such a heat as will admit of their being finished in good form with a button set, before the rivet has cooled to a critical point. As often as may be deemed advisable for the purpose of testing

the work rivets shall be cut out at the direction of the inspector.

The quality of the rivet metal and the workmanship shall be such that the fracture of a rivet so removed at random shall show a good tough, fibrous structure, without any crystalline appearance, and there shall be no evidence of brittelness.

Loose rivets must be promptly replaced, no rivet calking being permitted.

All seams must be calked thoroughly tight with a round-nosed calking tool, by workmen of acceptable skill. Great care must be taken not to injure the under plate. All workmanship must be first class in every particular. Defective material and workmanship may be rejected at any stage of the work and must be properly replaced by the contractor as directed.

After completion the tank shall be tested by filling with water, and the leaks, if any, shall be promptly and thoroughly calked. The tank must be thoroughly water tight before acceptance.

All inspection shall be made under the direction of the Engineer or his authorized assistant and he shalll have general supervision of all work through the contractor or his representative.

[illegible].

[illegible] quality of the first metal and the corresponding [illegible] [illegible] that the fineness of a [illegible] to remove at random [illegible] shown [illegible] tests, [illegible] structures, [illegible] [illegible] line appearance, and there shall be no evidence of [illegible].

Loose rivets must be promptly replaced, no rivet [illegible] [illegible] rotor permitted.

All seams must be filed thoroughly [illegible] with [illegible] [illegible] cutting tool, by workmen of acceptable skill. [illegible] care must be taken not to injure the under plate. All [illegible] [illegible] must be [illegible] in every particular. [illegible] [illegible] and workmanship may be rejected at any time [illegible] [illegible] must be promptly replaced by the contractor [illegible] [illegible].

After completion the tank shall be tested by filling [illegible] water, and the joints, if any, shall be promptly and thoroughly [illegible] [illegible]. The [illegible] be thoroughly water tight before [illegible] [illegible].

All inspection shall be made under the direction of the [illegible] or his [illegible] and assistant and he shall have [illegible] [illegible] supervision of all work through the manufacture, or its [illegible] [illegible].

TANK SPECIFICATIONS (detailed).

There will be required one steel tank thirty (30) feet in internal diameter and thirty-five (35) feet in height with a hemispherical bottom. All bidders shall submit with their bids detailed plans showing in all particulars the details of the tank that they propose to construct. The tank constructed shall conform with the plans and specifications on file at the office of the Water Works Committee. Details not shown in the plans and specifications than on file shall be worked out by the bidder and shall be in accordance to the best modern practice on such structures. The details must meet the approval of the Engineer.

Other factors being equal preference will be given to the bidder submitting the best details.

The tank shall consist of seven rings or courses and shall measure exclusive of seams or lap joint five (5) feet to each course and each course shall not contain more than five (5) plates.

The thickness of plates will be determined by a micrometer caiper; all plates "under gauge" will be rejected. The lap for double riveted joints shall be six (6) diameters of rivet in width. The laps for single riveted joints shall be three (3) diameters of the rivet in width.

The vertical seams of all courses shall be double riveted. All roundabout seams shall be single riveted.

All seams in the circular course shall be lapped and the rivets driven hot and finished with a hand set. The vertical seams in each course of the tank, to break joint

[illegible] at [illegible] vertical [illegible] in the [illegible] be-
low. All [illegible] under [illegible] will have [illegible] ma-
chine made, [illegible] and [illegible] [illegible] [illegible].

The edges of all plates shall be carefully trimmed to a [illegible] level, and be cutted with a [illegible] blunt tool; and all joints shall be made water tight, [illegible] and free of presence of water in the tank, and [illegible] level or weakest of any kind.

There shall be provided two [illegible], on the out side of tank from the balcony to trap door in roof, and the other reaching from the roof to the bottom of the tank, on the inside.

The tank will be covered with a roof composed of a [illegible] thickness of boards and [illegible].

The roof to be covered with 1/8" steel plates. A trap door shall be provided in roof, permitting access to the interior of the tank.

There will be required a [illegible] in the drawing above referred to a circular hole twelve (12) inches in diameter, to receive the twelve (12) inch cast iron inflent pipe as per detail.

In the erection of the tank, the upper and lower rivet holes in the vertical seams, shall be first "[illegible]" [illegible] holes, and [illegible] holes [illegible] not correspondingly, in figure [illegible] until the rivet will pass through, and the head rest [illegible] on the plate, and there the rivets will [illegible] [illegible] [illegible] one-thirteenth (1/13) inch, [illegible] [illegible] be

reamed to take the next commercial size of rivet.

In erecting the tank the rings or courses shall be kept concentric to a "plumb" line, suspended from the inside staging truly over the center of the tank bottom, and any rings which under this condition come out of "plumb" or which may not be concentric to the ring next below, or to the "plumb" line, shall be rejected.

The hemispherical bottom shall be constructed of steel plates, which shall be bent to the curvature while cold.

TOWER SPECIFICATIONS (General).

All bidders shall submit with their bids detailed plans showing in all particulars the details of the tower that they propose to construct. The tower constructed shall conform with the plans and specifications on file at the office of the Water Works Committee. Details not shown in the plan and specification there on file shall be worked out by the bidder and shall be in accordance to the best modern practice on such structures. The details must meet the approval of the Engineer.

Other factors being equal preference will be given to the bidder submittting the best details.

All metal in the structure, except rods, which require welding or forging, will be steel. All steel comprising the principal parts of main posts must be made by the Open Hearth Process. All other steel may be made by either Open Hearth or Bessemer process.

All tests and inspection of material shall be made at the place of manufacture prior to shipment.

In erecting the bin, the tops of the walls will be concentric to a "plumb" line, suspended from the inside ceiling truly over the center of the bin bottom, and no rings which under this condition come out of "plumb" or which may not be concentric to the ring next below, or to the "plumb" line, shall be rejected.

The hemispherical bottom shall be constructed of steel plates, which shall be true to the curvature this call.

[illegible]

All bidders shall [illegible] in their descriptive [illegible] in all particulars the details of the tower that they propose to construct. The tower constructed shall conform to the details and specifications on file in the office of the Water Works Committee. Details not shown in the plan and specification shall have on file and noted by the bidder and shall be in accordance to the best and approved practice on such structures. The details must meet the approval of the Engineer.

Other designs shall be considered preferences [illegible] to the bidder submitting the best details.

All metal in the structure, except rivets, bins or the welding or soldering, will be steel. All steel conforming to principal parts of an in good [illegible] Open Hearth Process. All [illegible] Open Hearth or Bessemer process.

All [illegible] and shapes [illegible] [illegible] to assignment.

Specimens for determining the tensile strength, limit of elasticity and ductility, shall be determined from a standard test piece cut from the finished material.

Rivet steel shall show an ultimate strength of from 48,000 to 58,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Elongation (1,400,000/ultimate) strength.

Bending test, 180 degrees flat upon itself without fracure on the outside of bent portion.

Structural steel, the same as above, except that the strength shall be 55,000 to 65,000 pounds per square inch.

In steel made by the acid process, the phosphorous limit shall be 0.08 per cent; made by the basic process, 0.04 per cent.

Wrought iron used in making rods shall be first class refined iron, known as best bridge iron. The surface must be free from blisters, cinder spots or other injurious defects. Must be made welded together, without seams or ragged or torn edges.

Broken fragment shall show a good fiber, clear and clean, free from cinder spots and other foreign material.

LOADING.

The structure shall be proportioned for the following loads:

1. The weight of the structure.
2. The weight of the water in the tank.
3. A wind pressure of 40 pounds per square foot over

[illegible] shall be [illegible] from [illegible].

Steel tubes shall show an ultimate strength of from 55,000 to 65,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Compression [illegible] strength.

Bending test, 180 degrees flat upon itself without fracture on the outside of bent portion.

Structural steel, the same as above, except that [illegible] 55,000 to 65,000 pounds per [illegible].

In steel made by the acid process, the phosphorous [illegible] shall be 0.08 per cent; made by the basic process, [illegible].

Round iron used in making rods shall be first class wrought iron, known as best refined iron. The surface must be free from blisters, cinder pockets or other imperfections. Must be well welded together, without seams or rounded or lamination.

Broken irregular shaped pieces from iron, flat, round, oval, bars from cinder pots, are never used in bridges.

Finish.

The structure shall be proportioned for the following load:

1. The weight of the structure.
2. The weight of the water in the tank.
3. A wind pressure of 30 pounds per [illegible] feet over

the diametrical plane of tank, and a uniform lo d of 200 pounds per each vertical foot of tower. The wind forces will be assumed acting in any direction, and members must be proportioned for that direction which will give a maximum stress.

UNIT STRESSES FOR PROPORTIONING MEMBERS.

COMPRESSION.

Members in compression shall be designed by the following formula:

$P = 20,000 - 90\ l/r$

P = Allowed stress per square inch

l = Length between support in inches.

r = least radius of giration in inches

No mainpost to exceed 125 radii of giration in length.

No other strut to exceed 150 radii of giration or such length that the fiber stress due to the bending from its own weight exceeds 4,000 pounds per square inch.

TENSION.

10,000 pounds per square inch net section in Plates.

18,000 " " " " " " " Bracing.

SHEAR.

7,220 pounds per square inch.

BEARING.

15,000 pounds per square inch on rivets.

20,000 pounds " " " " pins

200 " " " " " concrete

[illegible] of 10 ft. The [illegible] [illegible] in my direction, [illegible] [illegible] [illegible] direction which will give [illegible] [illegible].

[illegible]

[illegible]

[illegible] in compression shall be determined by the follo- [illegible]:

[illegible] = [illegible] - [illegible] L/r

[illegible] = [illegible] pounds per square inch

L = Length between supports in inches.

[illegible] = Least radius of gyration in inches

No [illegible] to exceed 120 radii of gyration in length.

No other [illegible] to exceed 150 radii of gyration or [illegible] length. [illegible] the differences due to [illegible] from the [illegible] vertical exceeds 4,000 pounds per square inch.

[illegible]

10,000 pounds per square inch net section in Tension.

12,000 " " " " " " " Bending.

[illegible]

7,000 pounds per square inch.

[illegible]

15,000 pounds per square inch on pinnie.

30,000 pounds " " " " " pins

" " " " " concrete

For wind stresses the above unit stresses may be increased by 25 per cent.

DETAILS OF CONSTRUCTION.

Anchor bolts shall always be provided. In cases where the wind force (the tank being empty) produces unstable equilibrium, they must be of such strength as to prevent over-turning.

Compression members shall be of the open type, no closed section being used.

Bearing plates for distributing pressure over the foundations must be attached in such a way as to evenly distribute the load throughout the entire area.

All joints to be made in main posts above, and as near as practical to a horizontal strut. Splices are to be made with plates on all sides of the columns with sufficient rivets or bolts to thoroughly hold the parts together.

The distance between connections of lattice or lacing bars to the flange of a channel shall not exceed two times the depth of the member, nor shall they be inclined to the axis of the same less than 45 degrees. The thickness of the lacing bars should not be less than one-sixtieth of this distance. Lattice bars shall be riveted at their intersections. The width of the lattice and lacing bars shall not be less than 2 1/2 times the diameter of the rivet used.

The size of the rivet for various members: 3/4" throughout.

In angles and other shapes the diameter of the rivet

[illegible] wind stresses [illegible] stresses may be increased by 25 per cent.

[illegible]

Anchor bolts shall always be provided. In cases where the wind force (the overturning moment) produces unstable equilibrium, they must be of such strength as to prevent [illegible].

Compression members shall be of the open type, no closed section being used.

Bearing plates for distributing pressure over the foundations must be designed in such a way as to evenly distribute the load throughout the entire area.

All joints to be made in as few places as possible, and as near as practical to a horizontal strut. Splices are to be made with plates on all sides of the columns with sufficient rivets or bolts to thoroughly hold the parts together.

The distance between connections of lattice or lacing bars to the flange of a channel shall not exceed two times the depth of the member, nor shall they be inclined to the axis of the member less than 45 degrees. The thickness of lattice bars should not be less than one-fiftieth of [illegible] frames. Lattice bars shall be riveted at their intersections. The width of the lattice and lacing bars shall not be less than 2 1/2 times the diameter of the rivet used.

The size of the rivet for various [illegible]

In no case [illegible] the diameter of the rivet [illegible]

will generally not be less than 1/4 of the leg of the angle used in the flanges. However, no greater rivet than 1" will be used.

In work that does not have to be calked the pitch of the rivets shall never exceed 6" or 16 times the thickness of the thinnest outside plate, nor be less than 3 diameters of the rivet.

In work that requires calking the maximum pitch shall never exceed 10 times the thickness of the thinnest plate used, and shall not be less than three diameters of the rivet.

The distance between the edge of any piece and the center of rivet hole must never be less than 1 3/4 times the diameter of the rivet, except for bars less than 3 1/2 times the diameter of the rivet in width.

A curved girder must connect the main posts to each other where the posts connect to the tank. This girder shall be connected to the tank by means of rivets pitched not greater than four diameters, and shall be of sufficient strength to stand the thrust and bending moments induced by the horizontal component of the stress in the posts, and shall be rigidly connected to the posts. Its outer flange shall be stiff enough to prevent sagging, or must be supported at intervals by means of braces to the tank.

At proper intervals horizontal rods from the main posts shall run out and connect to the inlet pipe to hold the same securely in position.

The inlet pipe must be so provided as to allow for changes of height of tower.

will [illegible] not be less than 1/4 [illegible] of the [illegible] used in [illegible]. However, no greater [illegible] than 1" will be used.

In work that does not have to be called the [illegible] of a rivet shall never exceed 6" or be less than the thickness of the timbered out side plate, nor be less than 3 diameters of the rivet.

In work that requires a tight the maximum pitch shall never exceed 10 times the thickness of the thinnest plate used, and shall not be less than three diameters of the rivet.

The distance between the edge of any piece and the center of rivet hole must never be less than 1 1/2 times the diameter of the rivet, except for lugs less than 3 1/2 times the diameter of the rivet in width.

A curved wing rivet connect the in pocket to each other where the pocket connect to the tank. The wing rivet shall be connected to the tank by means of rivets pitched not greater than four diameters, and shall be of sufficient strength to stand the thrust and bending moments induced by the horizontal components of the rivets in the pocket, and shall be rigidly connected to tank to. The outer flange shall be edge [illegible] to prevent [illegible] rivets, or [illegible] - at intervals by means of [illegible] to the tank.

At proper intervals horizontal rods from [illegible] shall run and connect to [illegible] inlet pipe to hold the [illegible] in position.

The inlet pipe must be so proportioned [illegible] the [illegible] of [illegible] to [illegible]. (7)

WORKMANSHIP.

All workmanship shall be first class. All abutting suffaces of compression members must be planed or turned to even the bearings so that they shall be in such contact throughout as may be obtained by such means. At the joint between the bearing plate and pieces directly above, the plate need not be planed. It however must be carefully straightened.

The diameter of the punch shall not exceed by more than 1/16 of an inch the diameter of the rivet used. All holes must be clean cut, without torn or ragged edges.

Rivet holes must be accurately spaced. The use of drift pins will only be allowed for bringing the several parts together, and they must not be driven with such force as to disturb the metal about the holes.

The rivets must completely fill the holes, having full heads concentric with the rivet, of a height not less than 6/10 the diameter of the rivet, and shall be in full contact with the surface or be counter sunk when so required, and machine driven wherever practical.

Built members must, when finished, be true and free from twists, kinks, and open joists between component pieces. The diameter of the hole shall be not greater than that of the pin by more than 1/32 of an inch.

All pins must be smooth and truly circular. Pilot nuts must be provided where necessary, to preserve the threads while pins are dirven. Fillers must be used wherever necessary on pins or bolts.

WORKMANSHIP.

All workmanship shall be first class. All abutting surfaces of compression members must be planed or turned to even bearings so that they shall be in such contact throughout as may be obtained by such means. At the joint between the bearing plate and pieces directly above, the plate need not be planed. It however must be carefully straightened.

The diameter of the punch shall not exceed by more than 1/16 of an inch the diameter of the rivet used. All holes must be clean cut, without torn or ragged edges.

Rivet holes must be accurately spaced. The use of drift pins will only be allowed for bringing the several parts together, and they must not be driven with such force as to disturb the metal about the holes.

The rivets must completely fill the holes, having full heads concentric with the rivet, of a height not less than 0.6 the diameter of the rivet, and shall be in full contact with the surface or be countersunk when so required, and machine driven wherever practical.

Built members must, when finished, be true and free from twists, kinks, and open joints between component pieces. The diameter of the pin hole shall not be greater than that of the pin by more than 1/32 of an inch.

All pins must be smooth and truly circular. Pilot nuts must be provided where necessary, to preserve the threads while pins are driven. Fillers must be used wherever necessary, as plate or bolts.

Detail pieces, if necessary may be bent hot without annealing. If a steel piece in which the full strength required has been partially heated, the whole must be subsequently annealed.

LADDER.

A latticed post may serve as a ladder from the ground to a point six feet below the balcony. From this point a ladder will extend to the balcony and from there to the top of the tank, being firmly secured thereto. When latticed posts are not used the ladder will extend to about eight feet above the ground.

PAINTING.

All work shall be covered before leaving the shop with one coat of graphite paint thoroughly mixed with pure boiled linseed oil and a small amount of Japan dryer, except the contiguous surfaces of the plates forming the tank. This portion shall not be painted. All other parts inaccessible after assembling must be well painted before assembling. After the work has been erected, the whole shall be painted with one coat of same, and all parts not accessible for painting after erection shall be painted before.

INLET PIPE.

The inlet pipe will generally be built of standard cast iron pipe, AND WILL BE FURNISHED TO THE BUILDERS OF THE TOWER, UNLESS OTHERWISE ARRANGED. The builders of the tower, however, to erect this pipe and connect same to tank.

[illegible]

[illegible] have been partially [illegible], the [illegible] be [illegible] [illegible] [illegible].

[illegible]

A [illegible] ladder from the [illegible] [illegible] air [illegible] below the balcony. From this point [illegible] will extend to the [illegible] and from there to the top [illegible] [illegible], [illegible] finally secure thereto. From [illegible] [illegible] and the ladder will extend to about eight [illegible] over the ground.

PAINTING.

All work shall be covered before leaving the shop [illegible] [illegible] of [illegible] paint thoroughly mixed with pure [illegible] linseed oil and a small amount of Japan dryer, except [illegible] on interior surfaces of the plates forming the tank. The [illegible] shall not be painted. All other parts [illegible] [illegible] something must be well painted before [illegible]. After the work has been erected, the whole shall be painted [illegible] coat of same, and all parts not accessible for painting after erection shall be painted before.

[illegible]

The inlet pipe [illegible] will generally be built of [illegible] iron pipe, AND IF [illegible] TO THE BUILDING [illegible] TOWN, PROVIDE OTHERWISE [illegible]. The [illegible] of [illegible] [illegible] [illegible] [illegible].

ERECTION.

The builder of the water tower will erect the work, will put in place the inlet pipe, will build the roof and complete the work in all particulars, unless otherwise specified.

He will assume the responsibility such as is usually incurred by builders of such work, and at all times have a competent man in charge.

Rubbish and other unsightly material caused by his operations, will be removed or disposed of upon completion of the work.

In cases where the foundations are to be built by parties other than the builders of the water tower, the latter will furnish anchor bolts and sketch for setting the same, to the former, who will set these bolts in the foundations as they are built, locating them exactly as required by the accepted plan.

FOUNDATIONS

The foundations shall be concrete, built according to foundation plans furnished by the builder of the tower, and accepted by the Engineer.

Excavation shall be carried well below the frost line to a firm footing, deeper than shown on plans if necessary, to secure this result, but an increased cost, to be agreed upon. Wooden forms to bring the foundation to the shape indicated on the drawings shall be built for receiving the concrete, which shall be mixed and placed as follows:

[illegible]

The builder of the water tower will erect the work, [illegible] the inlet [illegible], will build the roof and [illegible]

[illegible] responsibility [illegible] insured by builders of such work, and at all times have a competent man in charge.

Rubbish and other unsightly material caused by his operations, [illegible] removed [illegible] completion [illegible]

In cases where the foundations are to be built by parties other than the builders of the water tower, the latter will furnish anchor bolts and washers for setting the same, [illegible] who will set these bolts in the foundations as they are built, locating them exactly as required by the [illegible] plan.

FOUNDATIONS.

The foundations shall be concrete, built according to [illegible] plans furnished by the builder of the tower, and [illegible] by the Engineer.

Excavation shall be carried well below the frost line [illegible] footing, deeper than shown on plans if necessary, to secure this result, but an increased cost, to be [illegible]. Wooden [illegible] the foundation to the [illegible] located on the [illegible] shall be built for receiving the [illegible], which shall be [illegible] and [illegible] as follows:

Concrete shall be made of one part Portland cement, three parts sand and five parts broken stone and gravel. The mixing of this concrete to be done by hand on platforms. The cement and sand shall first be thoroughly mixed dry by turning over and over until it is of uniform color. After this is done, the stone or gravel, thoroughly moistened, shall be added. The whole will then be thoroughly mixed by turning over with shovels, sufficient water being added to make the whole mass a tenacious and quaking mixture. The concrete so mixed shall be immediately deposited in the foundations in layers not exceeding six inches thick, each layer to be thoroughly and compactly tamped until the whole mass is perfectly solid, and free mortar appears on the surface. No concrete shall be put in the foundations which from any cause has been allowed to set or partially set.

NOTE:-- Concrete caps shall be mixed one part Portland cement, two parts sand, three parts broken stone, and shall be smoothly finished.

The anchor bolts shall be firmly held in place so that they will not be moved while depositing the concrete.

In the concrete specified as above, the cement used shall be one of the best brands of Portland. Its weight per cubic foot shall not be less than one hundred punds. After an exposure of one day in air and six days in water, it shall develop a tensile strength of not less than four hundred pounds per square inch. It shall be in prime condition.

The sand shall be coarse, sharp and clean, free from

[illegible]

[illegible] over or over until it is of uniform color. After it cons, the stone or gravel, thoroughly wet down, [illegible] [illegible]. The whole will then be thoroughly mixed by hand [illegible] with shovels, sufficient water being added to make the [illegible] homogeneous and quality mixture. The concrete [illegible] shall be thoroughly deposited in the foundation [illegible] [illegible] shall be tamped until the holes have been [illegible] completely filled, and the mortar appears on the surface. No concrete shall be put in the foundations when the [illegible] have been allowed to [illegible] [illegible].

[illegible] Concrete caps shall be mixed one part Portland [illegible], [illegible] parts sand, three part broken stone, and [illegible] finished.

[illegible] mortar joints shall be finally made in place so that [illegible] will not be moved while depositing the concrete.

[illegible] the concrete specified above, the cement used [illegible] one of the best brands of Portland. [illegible] [illegible] shall not be less than one hundred pounds.

[illegible] exposure of one day in air and [illegible] in water, [illegible] develop tensile strength of not less than [illegible] pounds per square inch. [illegible] in prime condition.

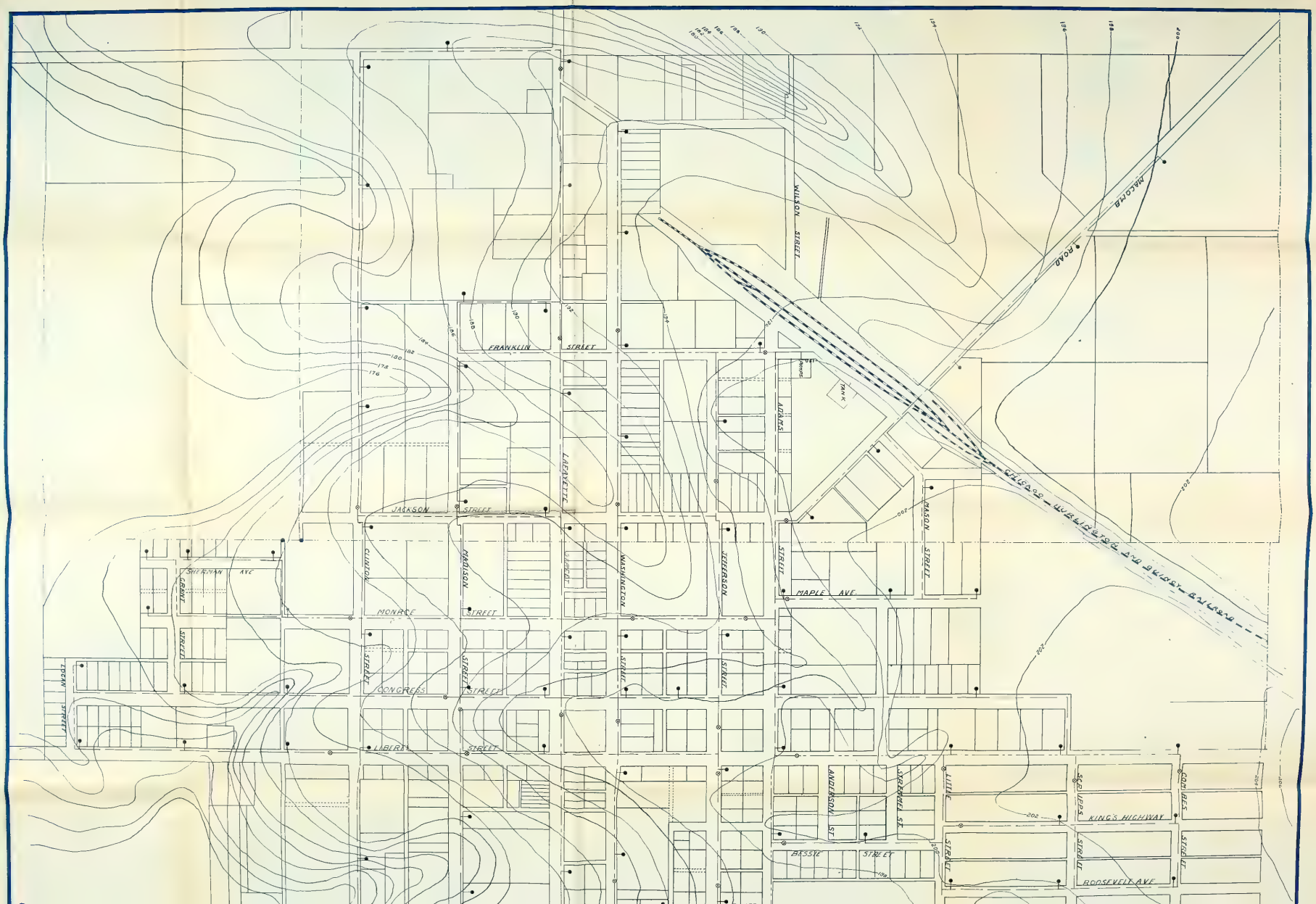
[illegible] shall be coarse, sharp and clean, free from

clay or loam.

The broken stone or gravel shall not be larger than two inches in any direction, and shall be entirely free from dirt and other foreign substances.

If the location of the work is such that considerable economy can be obtained by the use of either rubble masonry or hard burned brick instead of concrete, as specified above, special arrangements and specifications will be made for the use of such material.

The right is reserved to reject any and all bids.


WILSON STREET
MACOMB ROAD
FRANKLIN STREET
JACKSON STREET
LAFAYETTE STREET
ADAMS STREET
JEFFERSON STREET
WASHINGTON STREET
MADISON STREET
CLINTON STREET
GRANT STREET
SHERMAN AVE
MONROE STREET
CONGRESS STREET
LIBERTY STREET
TOWN STREET
MAPLE AVE.
ANDERSON ST.
STRAMEL ST.
LITTLE STREET
BASSIE STREET
KINGS HIGHWAY
ROOSEVELT AVE
CHICAGO - WASHINGTON AND GREAT BALTIMORE


CITY OF RUSHVILLE
WATER SUPPLY SYSTEM
W G JENS
A G HINDERSON
Scale.
0 100 200 300 400 500 600 700 800 900 1000
COMBES STREET
KING'S HIGHWAY
ROOSEVELT AVE
SCRUPPS STREET
LITTLE STREET
STREMPEL ST.
ANDERSON ST
BESSIE STREET
DAWN STREET
MCALLISTER STREET
ST. LOUIS STREET
VIRGINIA STREET
DOUGLAS STREET
BUCHANAN STREET
LINCOLN STREET
LIBERTY STREET
LOGAN STREET
200
198
196
194
192
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188
186
184
182
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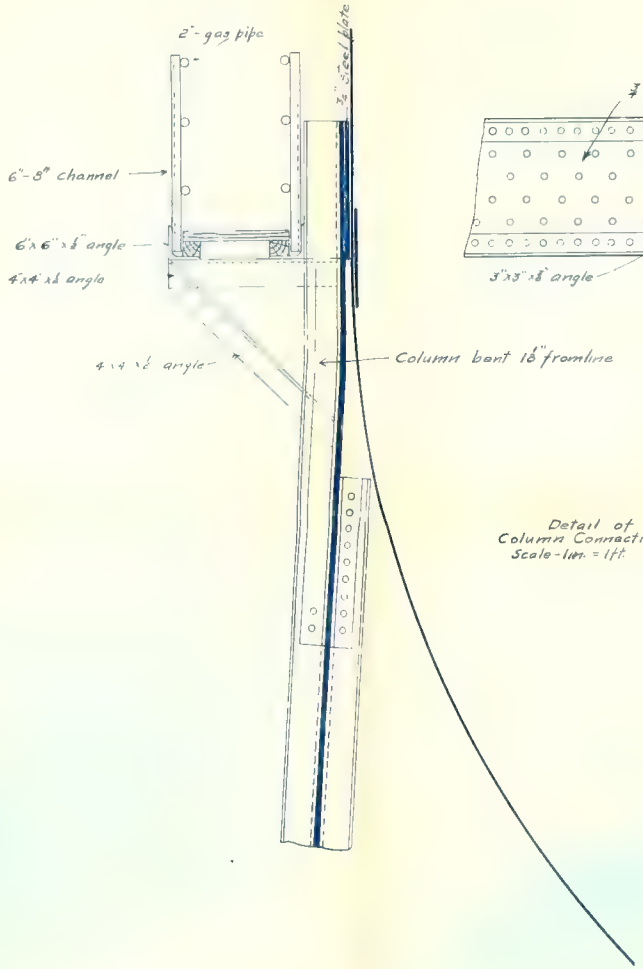
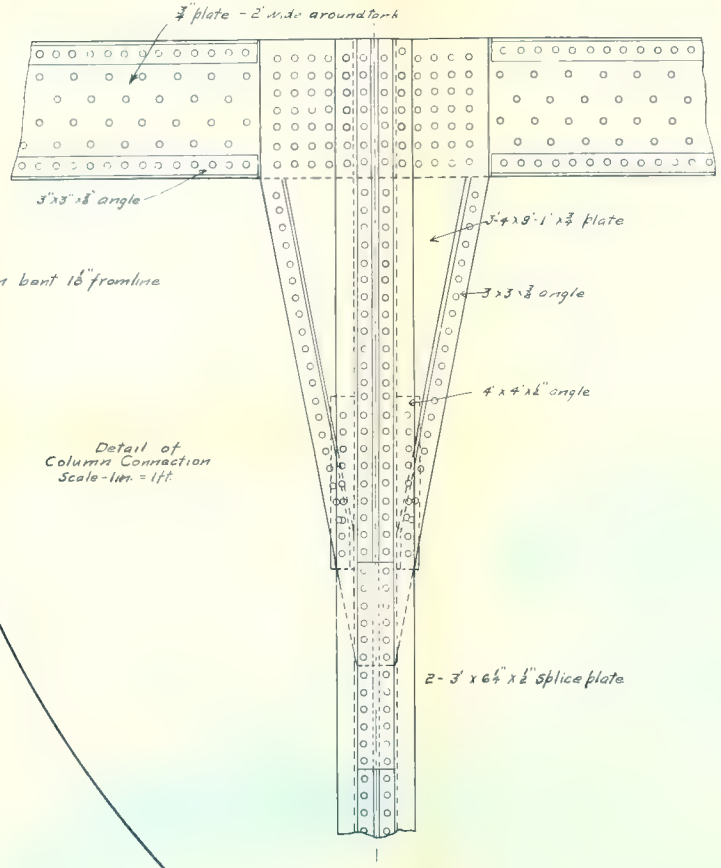
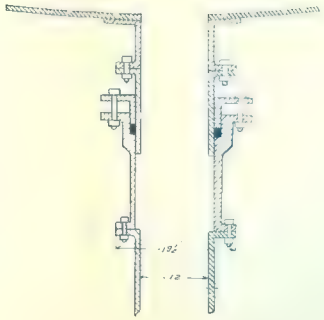
176
174
172
170
12 IN PIPE ARE SHOWN THUS
10 "
8 "
6 "
4 "
VALVES
HYDRANTS



Detail of
Column Connection
Scale - 1in. = 1ft.





Connection of inlet pipe to Tank
Scale 1in. = 1ft.

DETAILS

OF

230,000 GALLON ELEVATED TANK

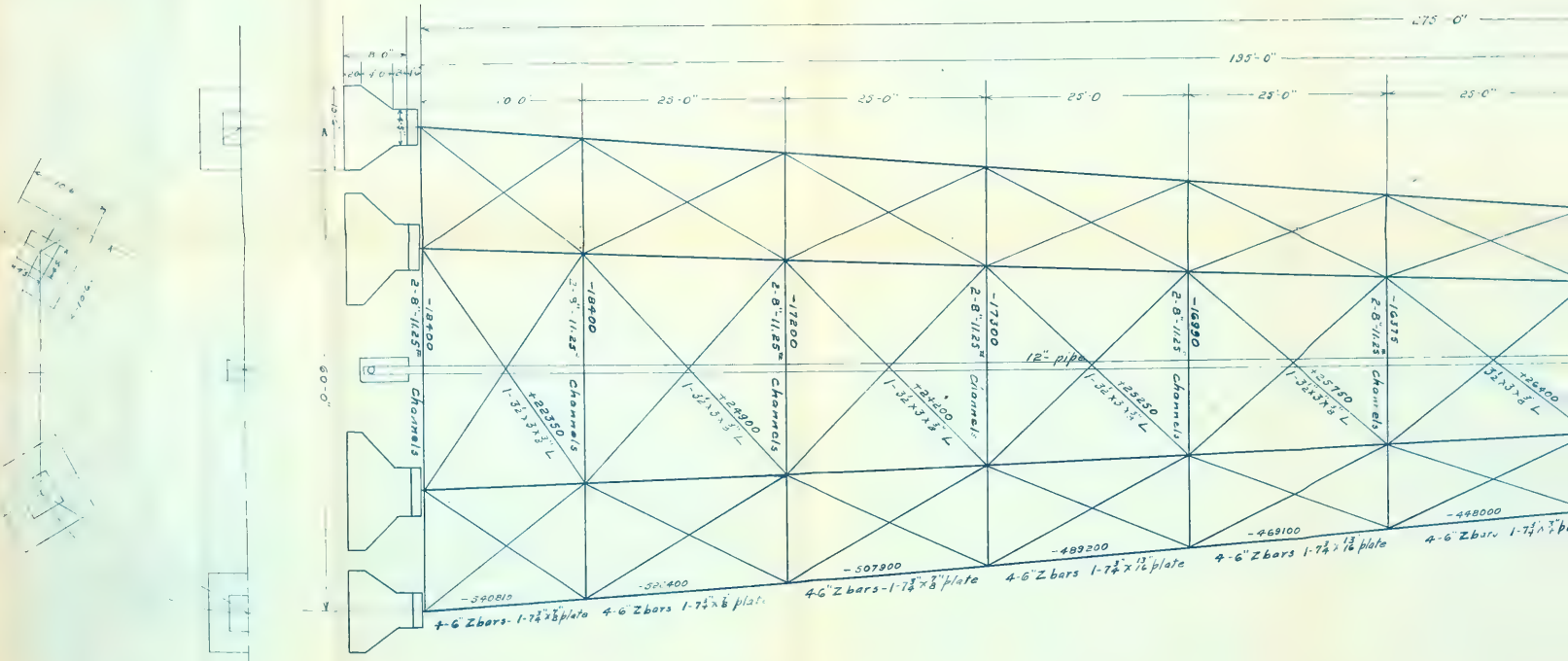
RUSHVILLE, ILL. WATER SUPPLY SYSTEM

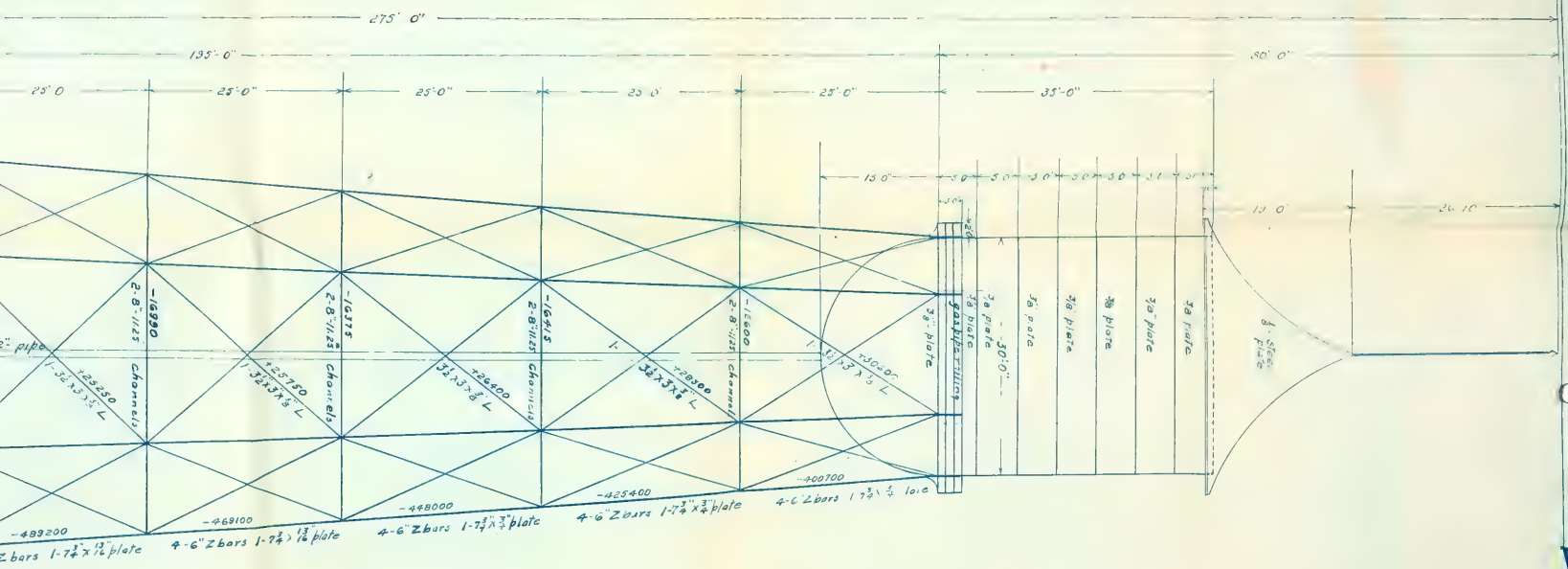
Scale 1in = 1ft.

May 10, 1910

W. G. Fenn.

G. G. Anderson


275'-0"
195'-0"
25'-0"
60'-0"
12" pipe
2-8"-11.25" Channels
-18400
-17200
-17300
-16990
-16375
+22350
+24900
+24400
+25250
+25750
+25400
-340810
-320400
-507900
-489200
-469100
-448000
4-6" Z bars-1-7¾"x⅝" plate
4-6" Z bars 1-7¾"x⅝" plate
4-6" Z bars-1-7¾"x⅞" plate
4-6" Z bars 1-7¾"x 13/16" plate
4-6" Z bars 1-7¾"x 13/16" plate



DESIGN

OF

230,000 GALLON ELEVATED TANK

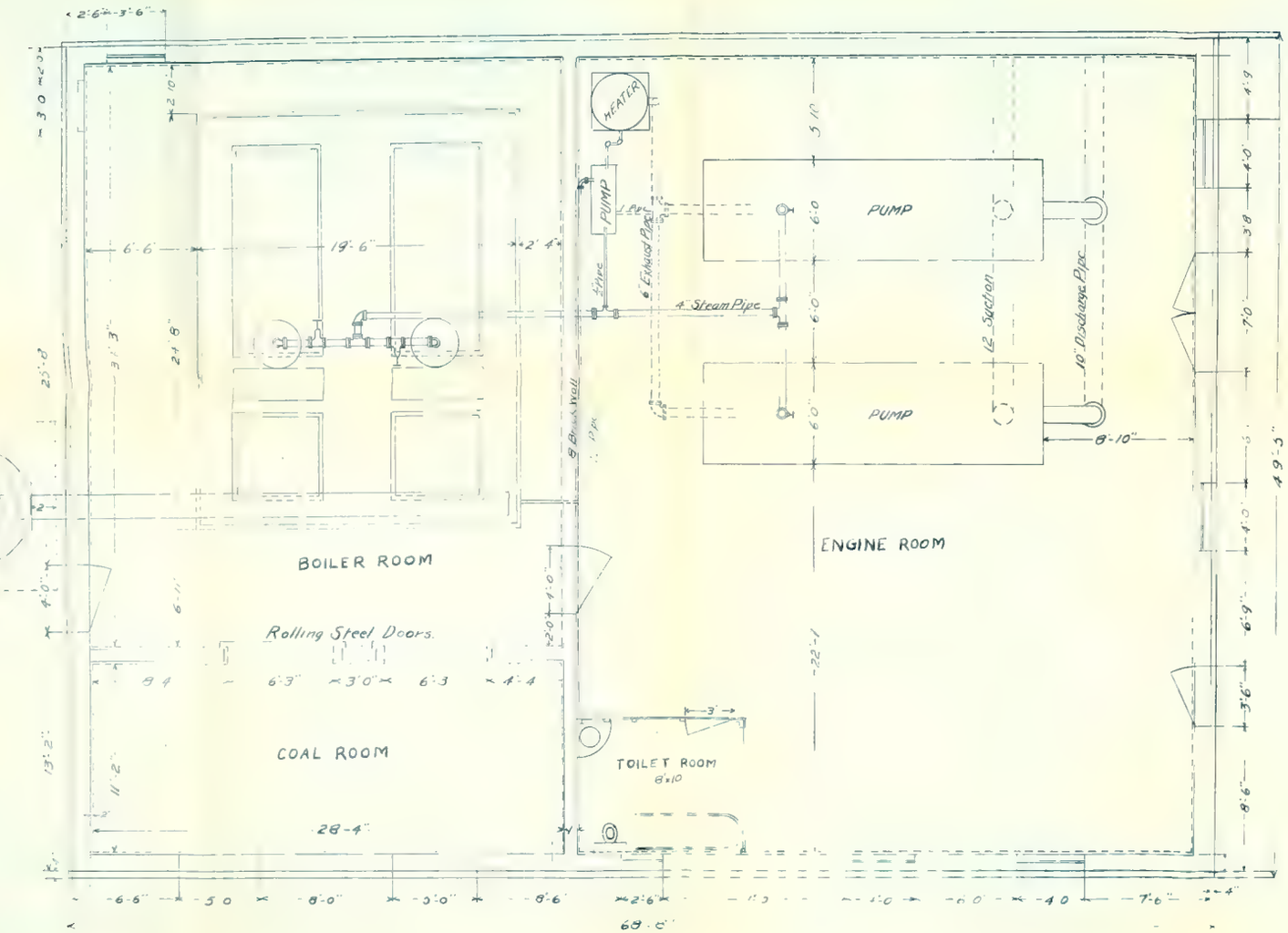
RUSHVILLE, ILL. WATER SUPPLY SYSTEM.

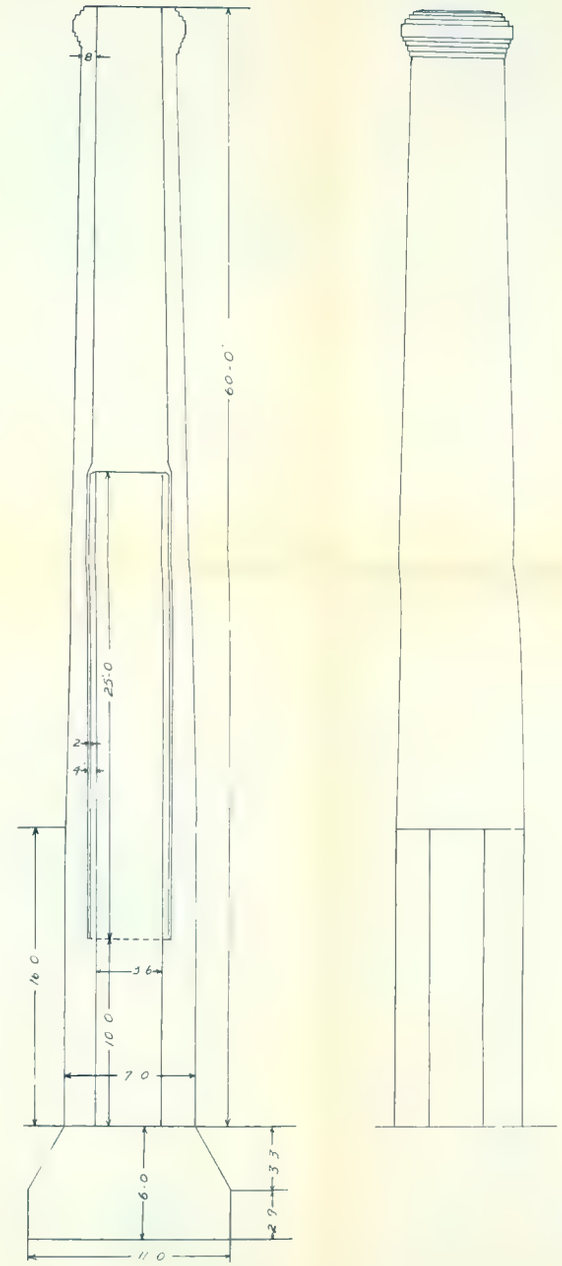
Scale 1/8 in = 1 ft.

May 10, 1910.

[illegible]

[illegible]





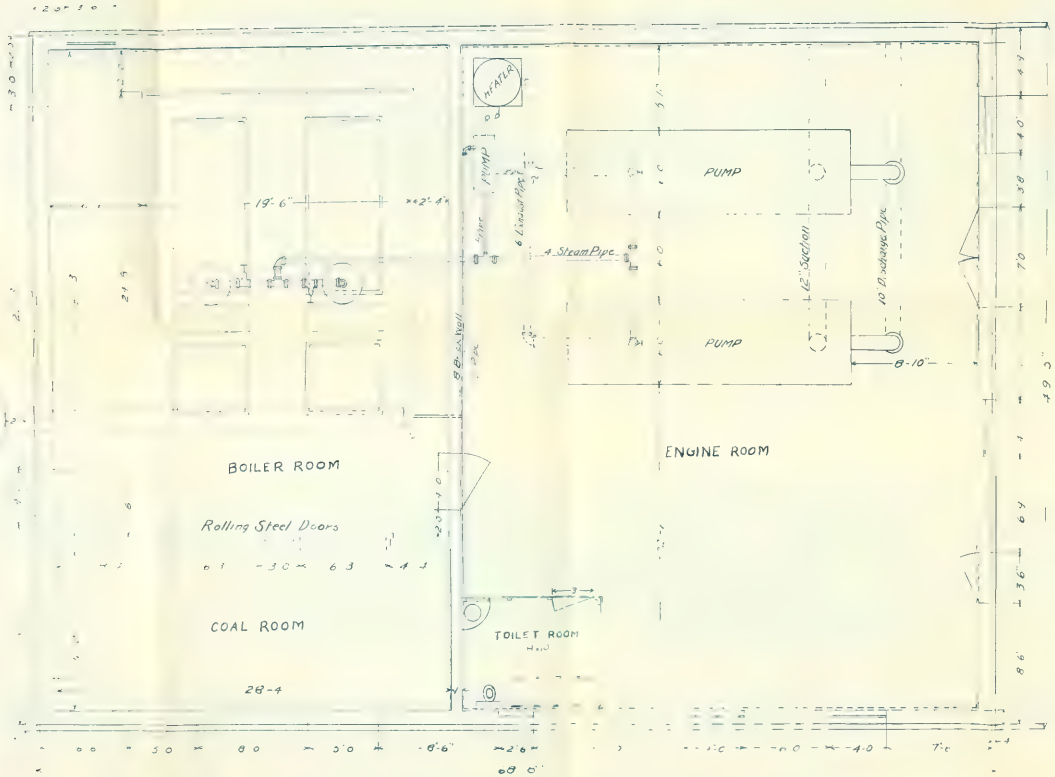
Compound Duplex Steam Pumps, 2" and 4" x 6"
Duplex Steam Feed Pump 4" x 6"
Boiler Horse Power 2 x 4

DESIGN
OF
1,100,000 GALLON PUMPING STATION.
RUSHVILLE, ILL. WATER SUPPLY SYSTEM

Scale ½ in. = 1 ft

May 10, 1910

H. Y. Jones.
R. E. Anderson



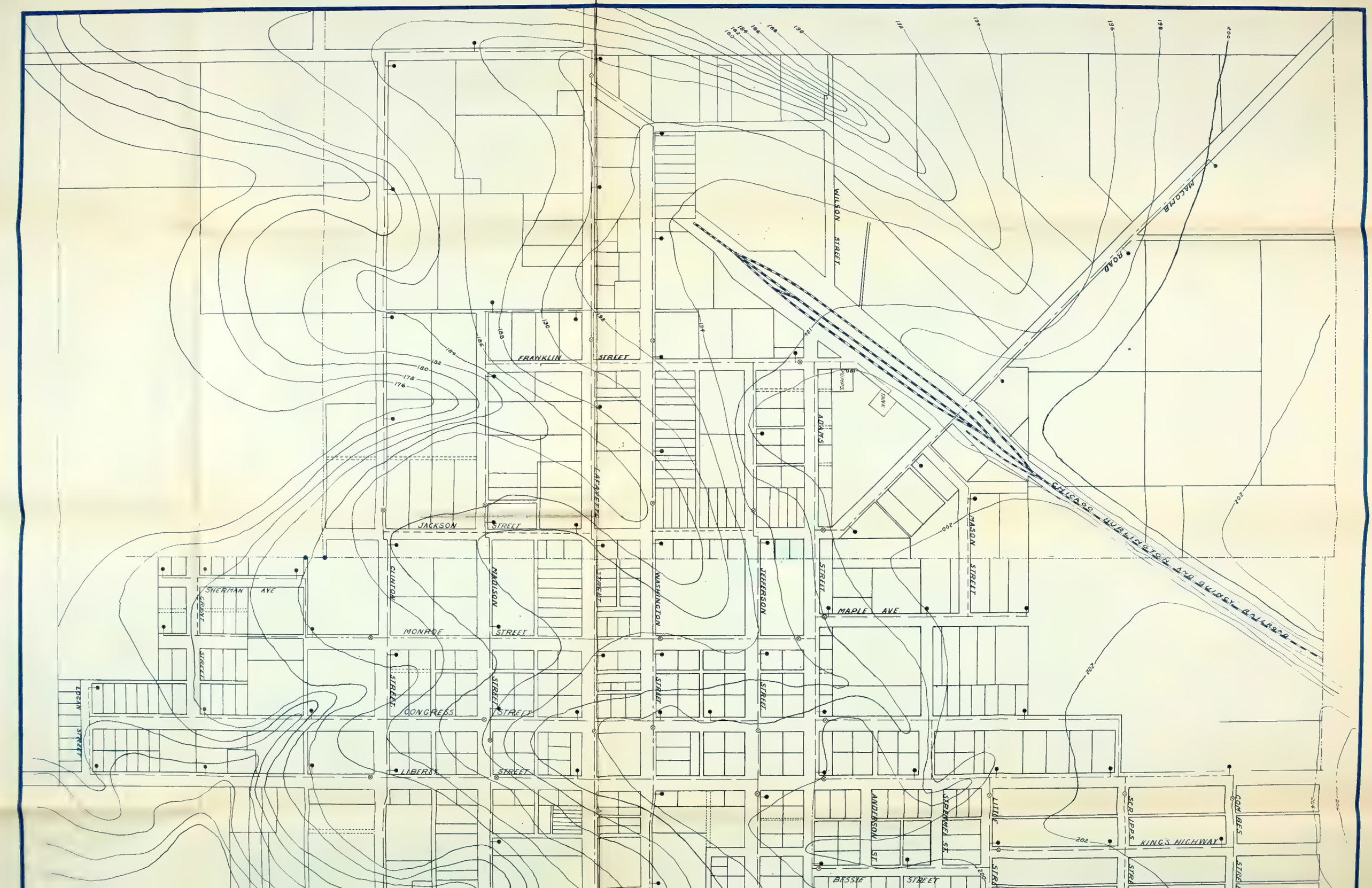
Compound Duplex Steam Pumps 20 and 4 x 6"
Duplex Steam Pumps 12 x 12"
Boiler Horse Power 223.4

DESIGN
OF
1,100,000 GALLON PUMPING STATION.
RUSHVILLE, ILL. WATER SUPPLY SYSTEM

Scale ½ in. = 1 ft

May 10, 1910

Hygeia
R. E. Anderson


WILSON STREET
MACOMB ROAD
CHICAGO BURLINGTON AND QUINCY RAILROAD
FRANKLIN STREET
TANK
TANK
ADAMS STREET
MASON STREET
MAPLE AVE.
JACKSON STREET
LAFAYETTE STREET
WASHINGTON STREET
JEFFERSON STREET
SHERMAN AVE
GRANT STREET
CLINTON STREET
MADISON STREET
MONROE STREET
CONGRESS STREET
LIBERTY STREET
LINCOLN STREET
ANDERSON ST.
SHERMAN ST.
LITTLE STREET
SCRIPPS
KING'S HIGHWAY
COMBES STREET
BASSIE STREET
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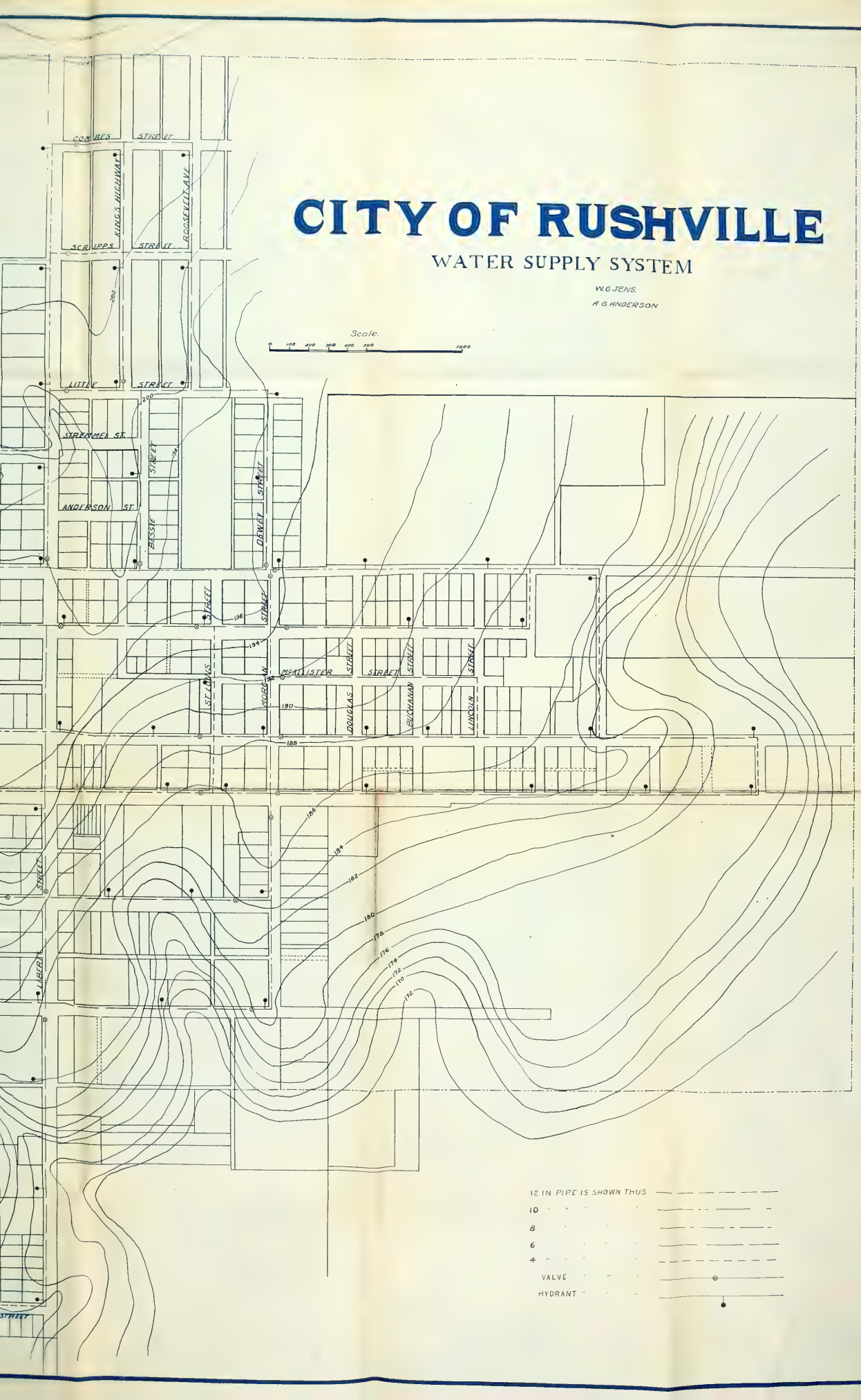
CITY OF RUSHVILLE
WATER SUPPLY SYSTEM
W. G. JENS.
A. G. ANDERSON
Scale.
0 100 200 300 400 500 1000
COMBES STREET
KING'S HIGHWAY
ROOSEVELT AVE
SCRIPPS STREET
LITTLE STREET
STREMMEL ST.
ANDERSON ST.
BESSIE STREET
DEWEY STREET
ST. LOUIS STREET
MORGAN STREET
MCALLISTER STREET
DOUGLAS STREET
BUCHANAN STREET
LINCOLN STREET
LIBERTY STREET
STREET
202
200
198
196
194
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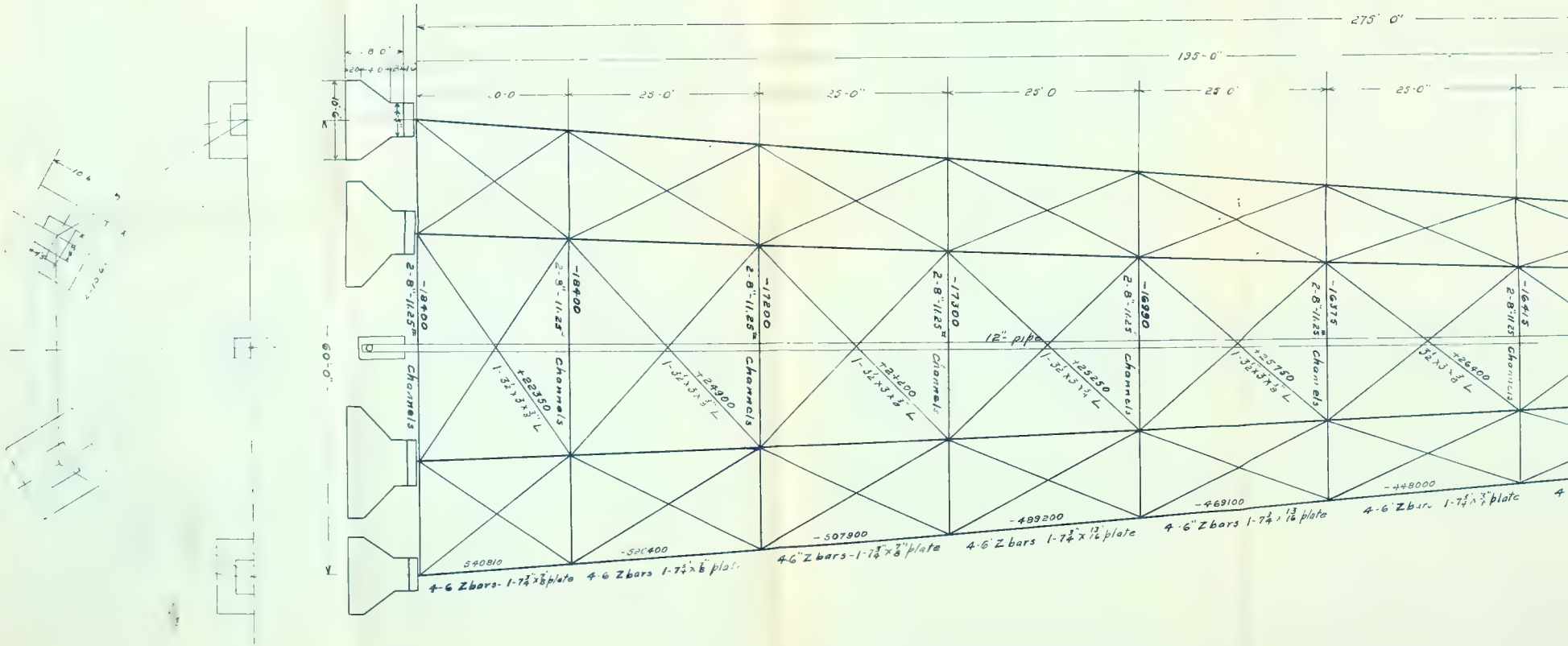
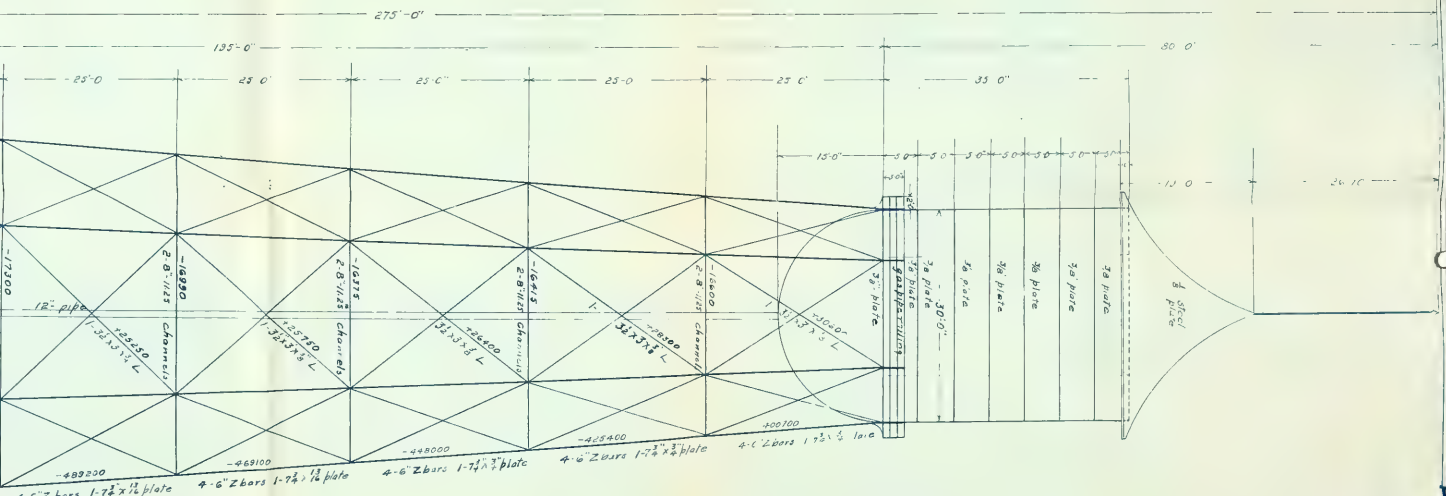
168
12 IN PIPE IS SHOWN THUS
10 " " "
8 " " "
6 " " "
4 " " "
VALVE " "
HYDRANT " "


275' 0"
135-0"
25-0"
25-0"
25-0"
25-0"
25-0"
25-0"
8-0"
10-0"
60-0"
12" pipe
2-8"x11.25" Channels
-18400
-17200
-17300
-16990
-16375
-16415
+22350
1-3½x3x⅜" L
+24980
1-3½x3x⅜" L
+24200
1-3½x3x⅜" L
+25250
1-3½x3x⅜" L
+25750
1-3½x3x⅜" L
+26200
3½x3x⅜ L
540810
-520400
-507900
-499200
-469100
-448000
4-6 Zbars- 1-7¾x⅞ plate
4-6 Zbars 1-7¾x⅞ plate
4-6" Zbars-1-7¾x⅞" plate
4-6" Zbars 1-7¾x13/16 plate
4-6" Zbars 1-7¾x13/16 plate
4-6" Zbars 1-7¾x⅞" plate



DESIGN

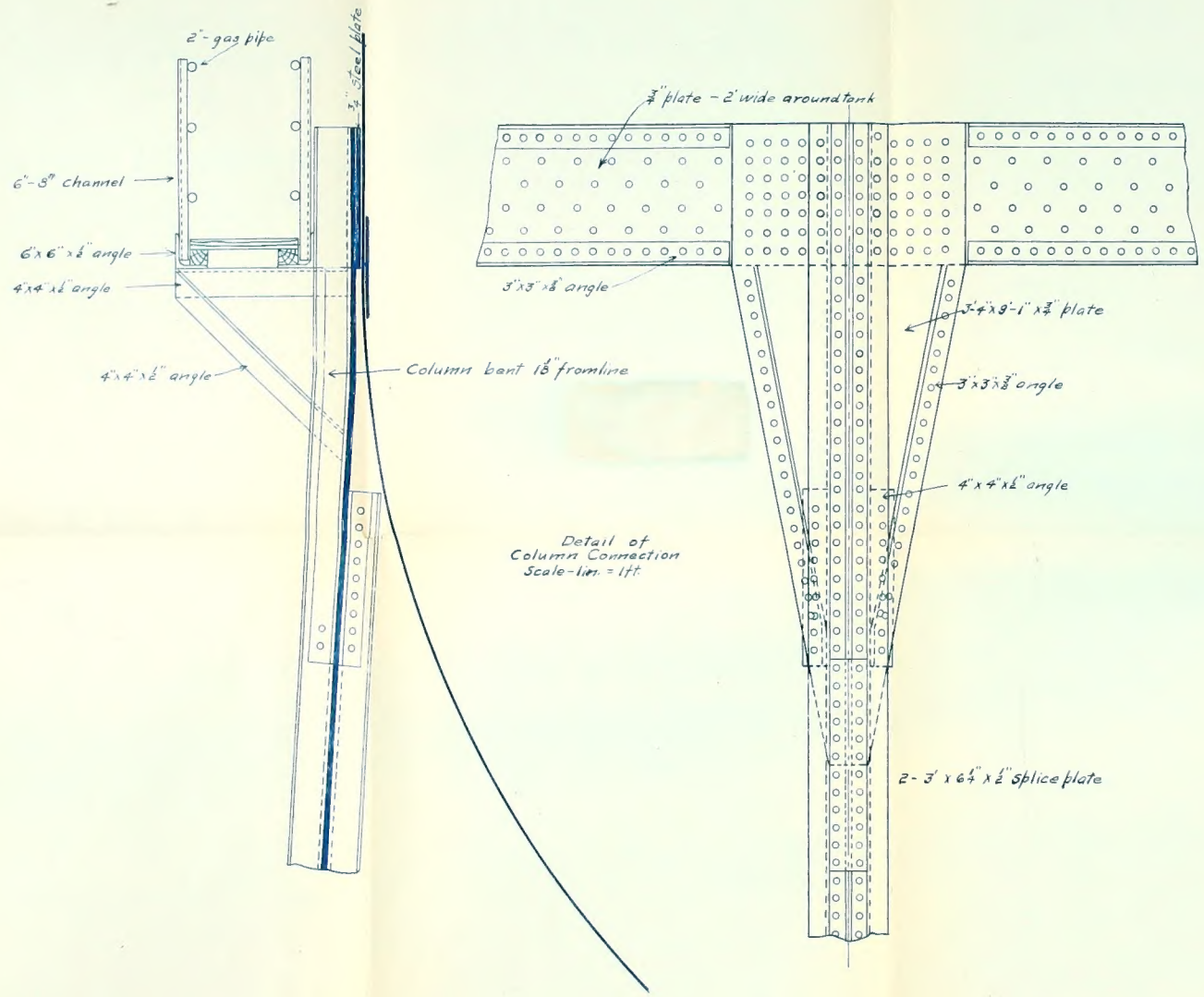
OF

230000 GALLON ELEVATED TANK

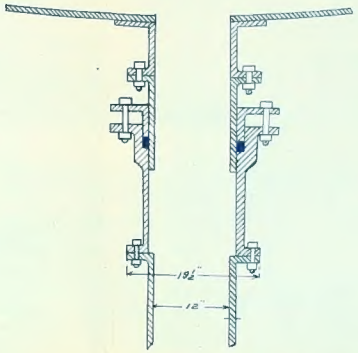
RUSHVILLE, ILL. WATER SUPPLY SYSTEM.

Scale 1/8 in = 1 ft

May 10, 1910



Detail of
Column Connection
Scale-1in. = 1ft.



Connection of inlet pipe to Tank
Scale 1in. = 1ft.

DETAILS

OF

230,000 GALLON ELEVATED TANK

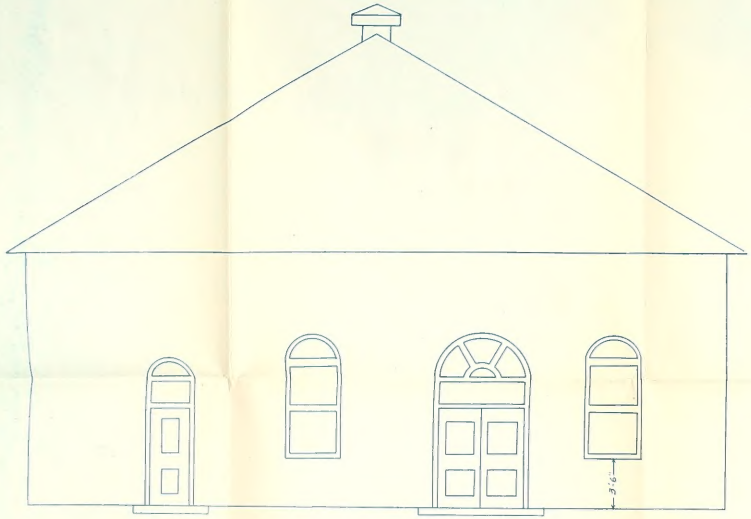
RUSHVILLE, ILL. WATER SUPPLY SYSTEM

Scale 1in. = 1ft.

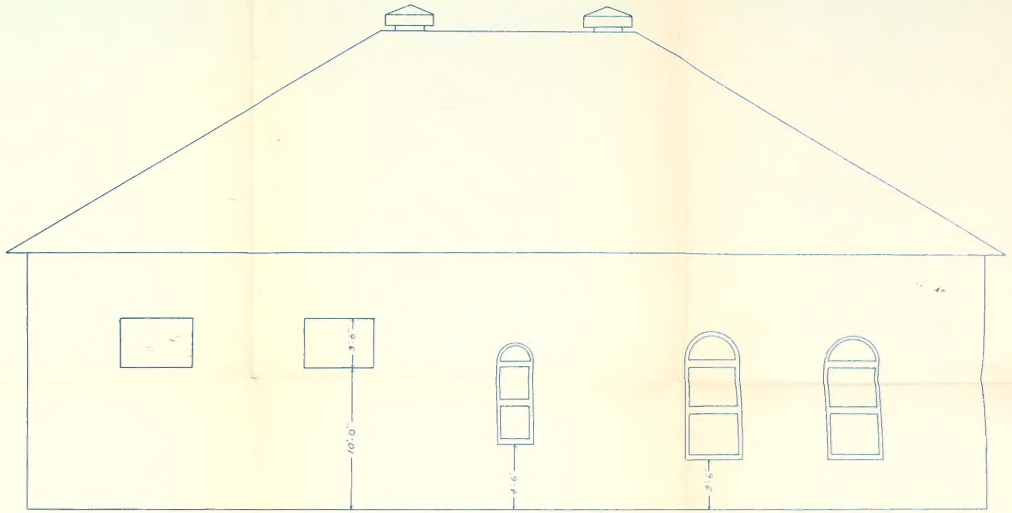
May 10, 1910.

W. G. Jones

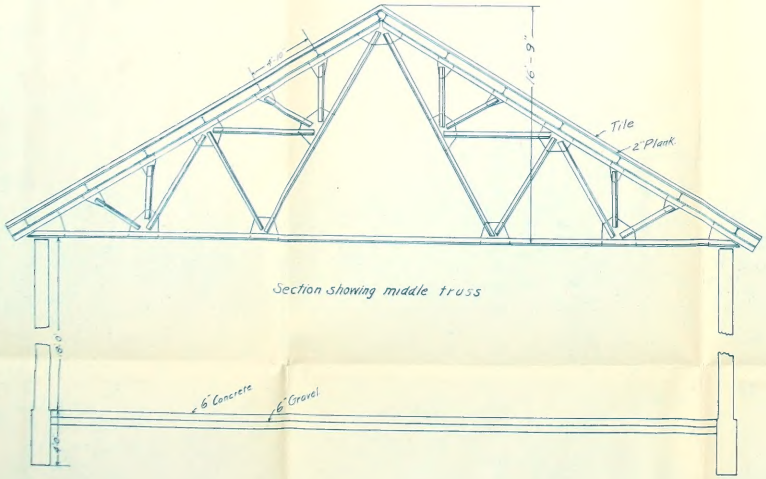
W. G. Anderson



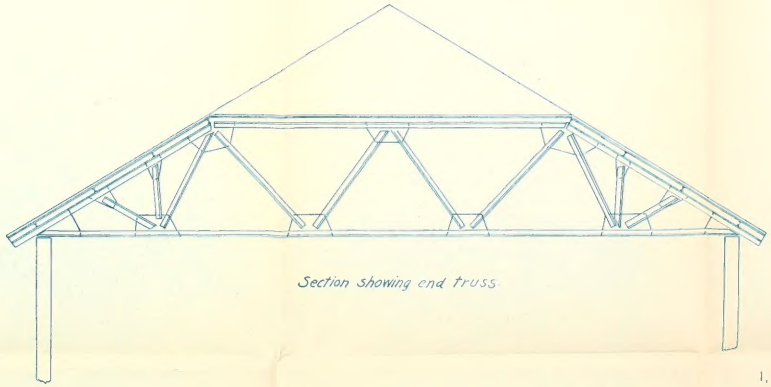
FRONT ELEVATION



SIDE ELEVATION



Section showing middle truss



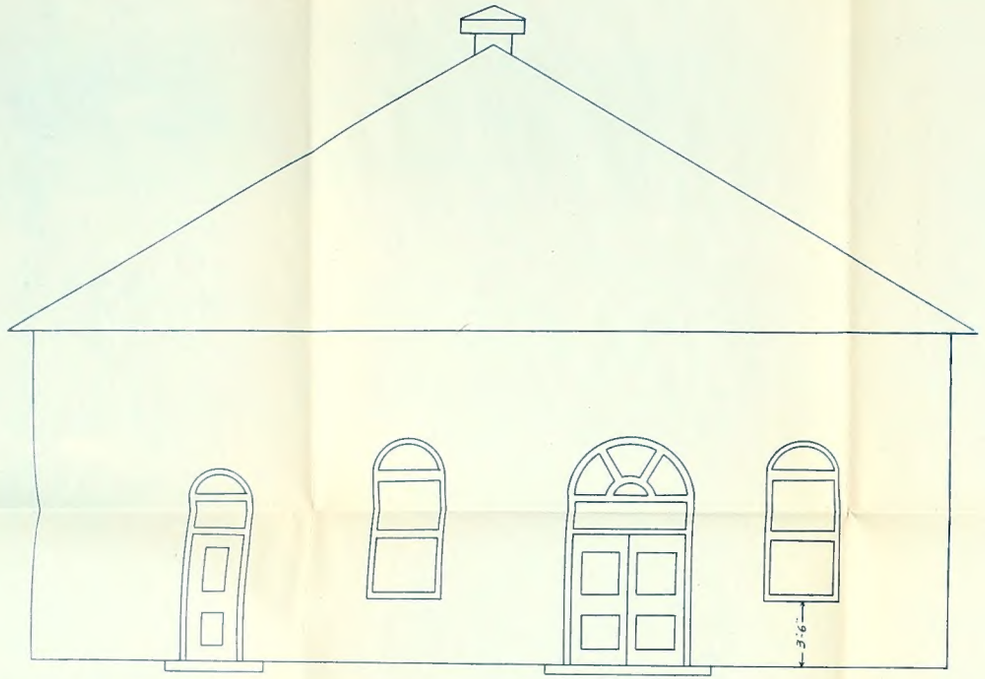
Section showing end truss

DESIGN
OF
1,100,000 GALLON PUMPING STATION
RUSHVILLE, ILL. WATER SUPPLY SYSTEM

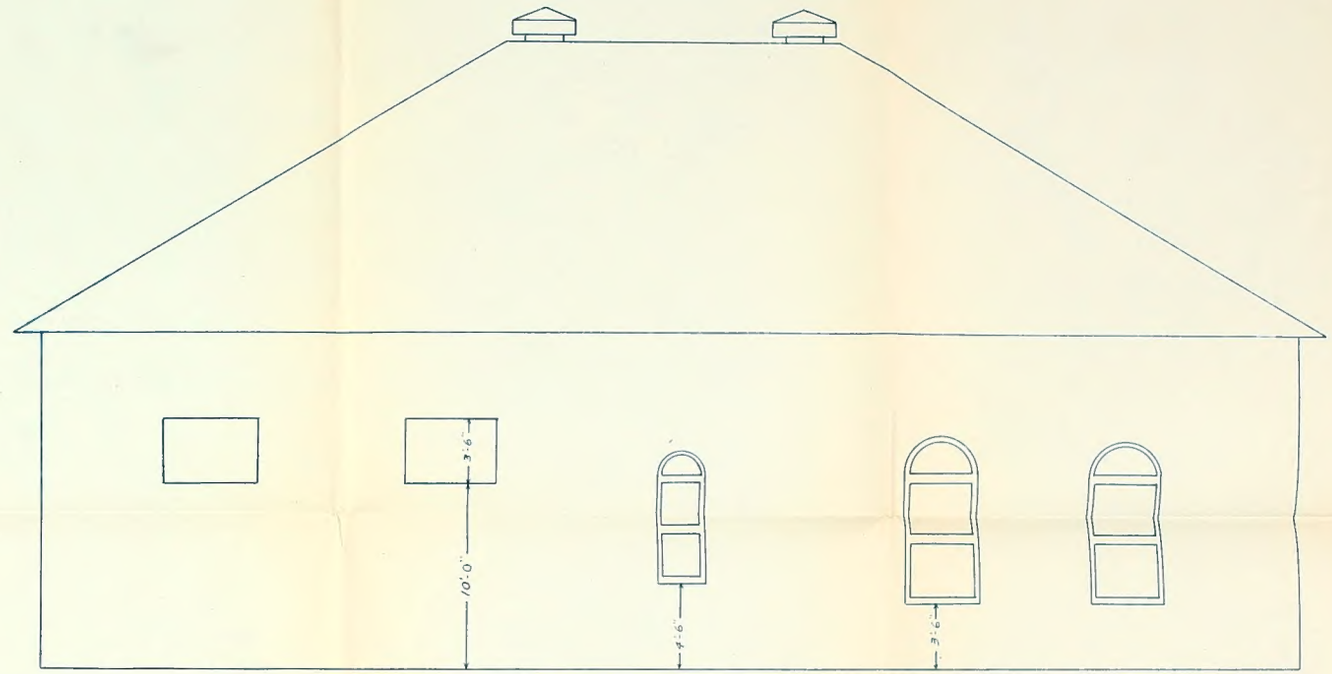
Scale ¼ in = 1 ft.

May 10, 1910

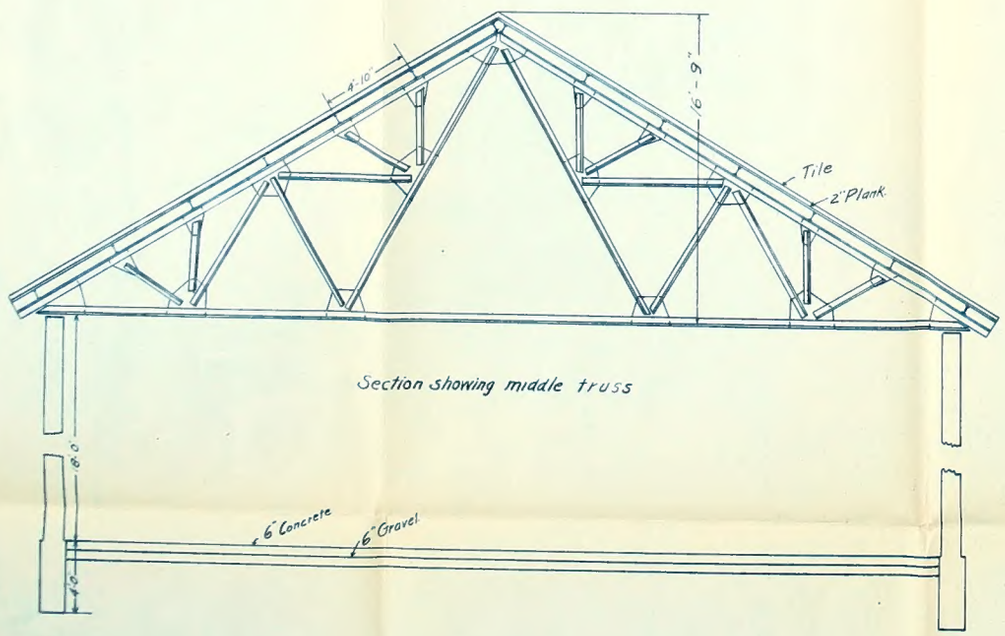
W. F. Jones
A. G. Anderson



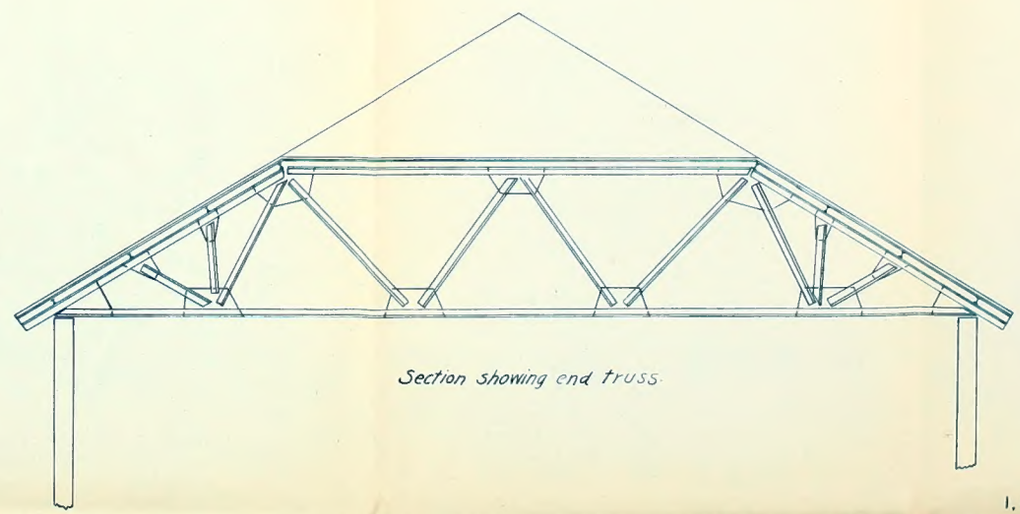
FRONT ELEVATION



SIDE ELEVATION



Section showing middle truss



Section showing end truss

DESIGN

OF

1,100,000 GALLON PUMPING STATION

RUSHVILLE, ILL., WATER SUPPLY SYSTEM

Scale ¼ in - 1 ft.

May 10, 1910

W. F. Jenn

A. G. Anderson